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ELECTRICAL REVIEW.

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THE

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THE EDUCATION AND TRAINING OF ENGINEERS.

THE important Conference held at the premises of the Institution of Civil Engineers last week, necessary and valuable though it was, suffered much through lack of time, and also by reason of the fact that different sections sat simultaneously. Thus, on the first day, Sections I and II (respectively labelled "General Education" and "Scientific Training") sat together, while Section III ("Practical Training") sat by itself. On the second day, Sections II and III sat together for half the time, and afterwards separately. If the object of the Conference was to blend the views of these three sections into some sort of coherent homogeneity, Section III should have participated with Sections I and II in the joint discussion on the first day. The consideration of the problems of practical training cannot be divorced from general education, and many times Section III had to be called to order by its chairman for its reference to subjects under discussion elsewhere.

Important though the Conference has been, we see the opinions of the engineering community grouped more or less in three divisions. There is the sandwich system of alternately six months at college and six months at works, possible only where college courses permit it, *i.e.*, in Scotland. Then we have for English conditions, first, those who favour a boy going straight from school into the works and then going to college, and, secondly, those who, on the other hand, prefer that the college course should follow immediately on the school course, the works training coming last. We return later to a discussion of the relative merits of the respective orders in which education and training should be taken. But at this juncture we feel bound to express our doubts as to whether a successful engineering education for a community can ever adequately be covered by any set programme or syllabus. Within certain limits, the man of superior ability and requisite common sense, who essays to earn his livelihood in one branch or other of the engineering industry, will do so, no matter how poor or how unorthodox his preliminary training may have been. Given sufficient incentive, the world will always produce its Stephensons, Watts, Trevithicks or Kelvins. Granted that the man of transcendent genius is rare, it is not inconceivable that if some such had, in their youth, been the bond-slaves of the examination-mongers, the letter of a standardised training would perchance have killed the spirit of originality which makes progress possible. We do not wish to be misunderstood by either school, for we know of engineers doing excellent work who are not mathematicians, and mathematicians whose work is equally valuable who are not engineers.

Obviously we cannot go back to the practical (or was it sandwich?) educational system of the late and unlamented

Mr. Squeers. "C-l-e-a-n, clean, verb active, to make bright, to scour. W-i-n, win, d-e-r, der, winder, a casement. When a boy knows this out of the book he goes and does it." It might, perhaps, be urged that the methods satirized by Dickens had some points of superiority over a course of study comprising lectures upon the chemistry of soaps, the coefficient of friction of elbow-grease, and the refractive index of plate-glass, without any practical reference to the utility of windows in domestic architecture. But, after all, it seems a fair question whether we are as far removed as we think from the crude educational methods of Mr. Squeers, or from their equally reprehensible antithesis. Hence it is that we have, on the one hand, a college training which teaches the student who has never ground a valve in its seat or seen a gland packed, the whole science of thermo-dynamics, and, on the other hand, the practice of putting a boy of 16 fresh down from a public school with all its healthy environment and mental and physical stimulus, into the shops for a period of months or years, because, forsooth, the discipline of 6 a.m. and the hard work may disgust some boys of engineering, and thus weed them out at an early age.

The immediate fruits of the present Conference will probably be that the new fashion will enforce one year in the shops, which is to intervene between school and college, that the college course should be of six-monthly periods of alternation with the works, and that where this is impossible, the long vacation should be spent in the shops, and a shop course follow upon the obtaining of a degree. There are, however, some very apparent drawbacks to this sudden taking of a boy straight from a public school to put him into works for about a year or more. It means an interruption in his course of studies at a time of greatest mental receptivity, an abrupt change of environment, no real opportunity of attaining to mechanical skill. The advantages of a year's roughing it seem none too certain. Four or five years would turn out a fair artisan; one year means acting as a sort of fitter's mate's mate, or being set to work at a turret lathe very much as half-timers are employed in Lancashire cotton mills. What insight can a boy of 16 get which will be helpful to him at college, and which will compensate for the interruption in the consecutiveness of his studies? We know, of course, that some will say, "Oh, make the boy attend evening classes." It is true that many possess the physique to work from 6 a.m. to 5 p.m. on a 9½-hour day, and to put in the evenings at a local technical college; but in all sections of the community, there are some who are not capable of doing so. Physical recreation and general culture, too, make claims which must not be neglected.

The subject is undoubtedly one of great interest, and of the utmost importance not only to the youths themselves, but also to the future well-being of the whole engineering profession. It is also of great complexity, and strong arguments can be advanced in favour of either of the leading theories. Further comments upon it must be deferred to a later occasion, but in the meantime we strongly recommend our readers—especially those whose sons are destined to become engineers—to read the report of the Conference which we commence elsewhere in this issue, and if possible to obtain copies of the introductory notes *in extenso*.

THE SEARCH FOR CHEAP POWER.

THE Presidential Address which Mr. Percy Rosling, M.I.E.E., delivered on May 11th to the Victorian Institute of Electrical Engineers, is interesting on account of the emphasis laid on the need for providing cheap power as a primary essential of commercial prosperity. It points to the two Australian cities, Melbourne—where the address was delivered—and Sydney, the capital of the neighbouring State. In Melbourne, for reasons which are detailed in the address, electrical energy is dearer than in Sydney. What is the result:—

> Melbourne used to be considered the leading business and manufacturing town in Australia, but as far as the use of electricity is concerned, it is content to take second place to Sydney, and as it is the most energetic and up-to-date people who appreciate the advantages of electricity, we must infer that there are more of this class in Sydney than in Melbourne; and therefore, generally, Melbourne is losing, or has lost, her pride of place.

Leading up to this question, Mr. Rosling discusses two problems as having, in his opinion, an important bearing on the subject. The first is the advisability of the general employment of a consulting engineer for public works, and the other is the policy which should be followed in the early stages of the development of an electricity supply undertaking.

These are old friends here, and much thought has been expended and a large amount of ink used in the search for correct solutions.

Dealing with the position of consultants, Mr. Rosling points out the disadvantages of entrusting the design of large works to individual contractors, who cannot help having a bias towards utilising plant in which they are interested, and with whose good points they are most conversant. He shows that in a new country, during the early stages of its development, matters must be left in the hands of contracting firms; the man on the spot gets the best results he can from the material at his disposal. When, however, progress has reached a certain point, final success, rather than immediate results, becomes the important factor, and to attain this, the wider outlook and more general experience of the independent engineer are often sought.

Whether a contracting engineer is suited thus to act impartially is considered in the address, and practically answered in the negative, though Mr. Rosling considers that the least objectionable manner in which he can so act is to prepare a specification, stand aside from personal tendering, and adjudicate on offers received only from his competitors. Methods by which a contracting engineer prepares a specification, personally tenders either directly or indirectly, and afterwards adjudicates on offers received and supervises the execution of the work, are rightly condemned. The personal opinion is given that the present condition of electrical engineering work in Australia affords an opportunity for the establishment of a consulting practice based on the high standards of British engineering work.

It is usual in Australian public contracts to insist on the engineering representative of the purchasing body being the sole arbiter in case of disputes, and one direction in which the advent of a strong independent engineer would be warmly welcomed, would be in insisting that the British plan of appointing an independent and impartial arbitrator should be followed. Another need is stated in the address

to be the development of the function of the true consultant to specify distinctly the results he requires, and to leave manufacturers and contractors to determine how they will obtain those results with their standard apparatus.

Having shown how the wise employment of independent engineers might help towards the cheapening of the cost of power by securing that the most suitable plant purchased under fair conditions should be used, Mr. Rosling proceeded to consider the right policy to be followed in the early stages of an electricity supply undertaking. Naturally, Melbourne, with its high rates for power, and its separate electricity authorities for different areas, afforded the text of how not to do it.

So far as the City itself was concerned, where the Town Council owned the plant, the policy—which had apparently been followed—of using the electricity undertaking as a constant feeder towards the reduction of general rates was severely condemned. It was shown that to expect profits during the early stages of the undertaking was distinctly detrimental to its rapid development. The plan adopted by some of the British power companies of fixing at the start on an output which would pay, and arranging the power rates on the basis of this output, irrespective of early losses in working, was referred to as the safest and soundest plan of operation, as this ensured the advantages of electricity being placed within the reach of all, and offered a real inducement towards its being employed for industrial purposes. Unless electrical energy were actually obtainable at low rates when industries were being started, other forms of power would be tried, and the load which might have helped to reduce standing charges would be lost. It was far harder to induce manufacturers to discard an already installed source of power than to persuade them to adopt electricity when it was obtainable at rates which compared favourably with the cost of its rivals.

It was felt that one way in which the Victorian Institute could most effectively help towards the consummation of the moderate hopes expressed in the address, was by the education of public opinion, more particularly as represented by the members of the Town Council. This is a direction in which much has been done, but more might be attempted even in this country. It is only when those who have the direct control of undertakings involving such technical questions as that of electricity supply, have the requisite knowledge of the true economics of supply that they can be expected to make them a success.

Mr. Rosling has done well to probe so fearlessly the reasons for the slow progress of electrical work in Victoria, and to show that if the State is to hold its own among its Sister States, it must consider more carefully than it has hitherto done, the problems which determine the cost at which power can be supplied within its borders for the development of industrial undertakings.

The Telephone Appeal.

THE uncertainties and eccentricities of British law were admirably illustrated by the verdict of the Court of Appeal in the action between the National Telephone Co. and the Post Office last week. The question turned upon the meaning of the word "unsuitable," together with its context. We always supposed that "unsuitable" meant "unfitted," or "inappropriate," for a specified purpose, relating only to quality; we now learn, however, that it relates to quantity, at least in the Postmaster-General's usage of the word, for on the ground that he has enough apparatus without that of the company, he alleges that the latter is "unsuitable" for his purpose, and therefore refuses to discuss its purchase. The fact that with the said apparatus the company is giving at least as good a service as that of the Post Office does not appear to have come into consideration at all, though to the ordinary person it would seem to settle the question at once. Truly, the ways of lawyers are mysterious and inscrutable. Unfortunately, we understand, the decision of the Court of Appeal in this instance was final—otherwise, no doubt, the case might have had a different issue.

As regards the attitude adopted by the Post Office towards the suitability of the plant in question, here using the word in its customary sense, we cannot say much on this point without trenching upon questions now *sub judice*; but we may be allowed to point out that the wholesale scrapping of large and costly plant, in efficient working order, and capable of being easily adapted at trifling cost for use with the system favoured by the Post Office, in order to substitute entirely new apparatus at a correspondingly greater price, is a proceeding which can hardly be justified from a business point of view.

Copper.

THE recent hardening in the price of standard copper is a little difficult to account for, in the face of visible supplies which, though decreasing, are still equal to about one-fifth of the annual production. A writer in the *Financial News* for June 26th, commenting on the fact that the price has risen during two months from £53 10s. per ton to the neighbourhood of £58, attributes this to a better market position in the States, which apparently means that the organising of the industry by the Amalgamated Copper Co. is beginning to bear fruit. Comparing production and consumption for the past 12 months (June, 1910, to May, 1911), the writer of the article gives a table showing that the quantity of copper consumed in the States during August, September and October amounted to more than 50 per cent. of the production, while in December and January this was less than 40 per cent., increasing to 50 per cent. in March, April and May of this year. This goes to show that the market is becoming brisker on a gradual improvement in the trades affected. Curtailment of production does not show up particularly on this table, the average per month being 54,433 tons, and the months of March, April and May this year registering 58,273, 52,717 and 56,679 tons respectively. Certainly, February only showed 49,080 tons. It is recorded, in this connection, that the Anaconda Co. has reduced its output in the past five months from 113 million lb. to 107 million lb., a reduction of something like 6 per cent. In the report of the Amalgamated Copper Co. for the year ending April 30th last, it is stated that the Anaconda Copper Mining Co. has acquired all the properties of the mining companies and timber and coal undertakings doing business in Montana and Wyoming in which the present company had any interest, and the stock of the United Metals Selling Co. At the same time, as the article remarks, the return made on copper shares at present prices is very small. Amalgamateds stand to return about $2\frac{3}{4}$ per cent., and Rio Tintos roughly $3\frac{5}{8}$.

Messrs. Merton's circular for mid-month gave stock in Europe and afloat at 70,416 tons, and total stocks for the end of May as 146,718 tons. American supplies had slightly increased from April-May, while European had dropped over 5,000 tons, and bids fair to be decreased by as much in the present month. This may have something to do with increased prices.

D

DISTRIBUTION AND EFFICIENCY TESTS ON LAMP SHADES AND REFLECTORS.

By LEONARD MURPHY, A.M.I.E.E., and H. L. MORGAN,
East London College.

Since the advent of the high-efficiency lamps now in general use, more attention has been paid than formerly to the design of shades and reflectors, as a badly arranged fitting may easily nullify the advantage gained by the use of the high-efficiency lamp.

It is, however, quite impossible to obtain a simple photometric test on any shade or reflector which will immediately express the merit of the particular arrangement for the class

Fig. 1.—Holophane Shade, No. 9673. (Combination II.)

of work for which it is required, but it is believed that if the figures for the efficiency and the polar curves of shades in common use are available, it will be possible to make a fairly accurate estimate of the qualities of any other arrangement.

In this direction much valuable work has been done by Messrs. The Holophane Glass Co. in connection with their well-known fittings, but this work is, of course, confined to that particular form of shade.

It is not easy to draw a line of distinction between shades and reflectors. No doubt some will fall distinctly into one

Fig. 2.—Holophane Shade, No. 6046. (Combination III.)

class and some into the other, but in many cases the object aimed at is both to prevent the eyes being dazzled and at the same time to concentrate the light in one direction. Thus the authors use the term "shade" indiscriminately, though in some of the arrangements described, the term "reflector" would, undoubtedly, be more accurate.

The work naturally falls under two heads :—

(*a*) The consideration of the polar distribution of the light from various combinations of lamps and shades, and of the amount of light absorbed in each case by the shade.

(*b*) The action of each in efficiently producing downward illumination, together with the minimum of glare and shadow.

The arrangements experimented upon were as follows :—

I. Bare lamps.

II. Lamps enclosed in Holophane reflector (pattern No. 9,673), illustrated in fig. 1.

III. Lamps enclosed in Holophane reflector (pattern No. 6,046), illustrated in fig. 2.

IV. Lamps fitted with conical opal shades 10 in. diameter, 5 in. deep.

V. Lamps fitted with exactly similar enamelled iron shades.

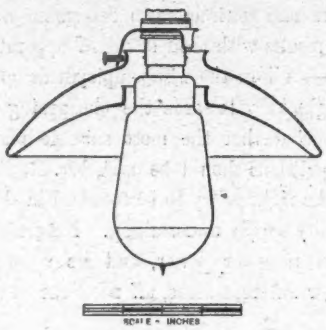

Fig. 3.—Silvered Glass Reflector. (Combination VI.)

VI. Experiments under (*a*) only were carried out on the lamp enclosed in a silvered glass reflector 8 in. diameter (see fig. 3).

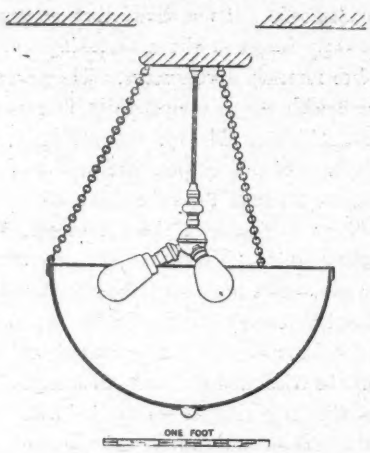

Fig. 4.—Opal Glass Bowl fitted with Three Lamps for Semi-indirect Lighting. (Combination VII.)

VII. Experiments under (*b*) were carried out on a group of three lamps within a hemispherical bowl 20 in. diameter (fig. 4). In this case the lighting was semi-indirect.

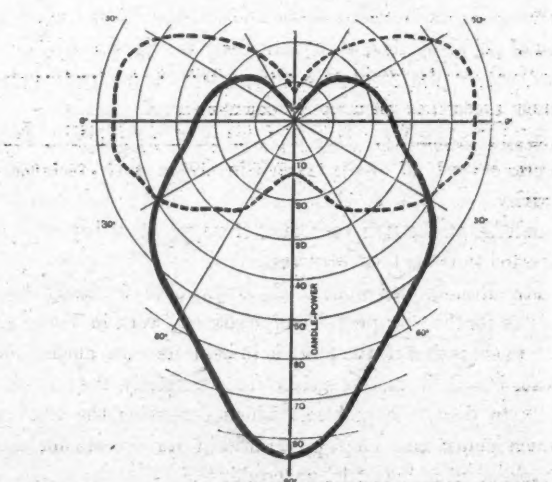

Fig. 5.—Polar Curve for Holophane Shade (No. 9673). (Combination II.)

The photometer* used for the experiments under (*a*) is of the swinging mirror type, and has been designed particularly for the photometry of arc lamps or other light

* For a description of this instrument see "The Measurement of Light and Illumination," by Prof. J. T. Morris, *The Ill. Eng.*, April, 1910.

sources where the light emanates from a fairly considerable area. The light source used for direct comparison was a small 4-volt tungsten lamp, which had previously

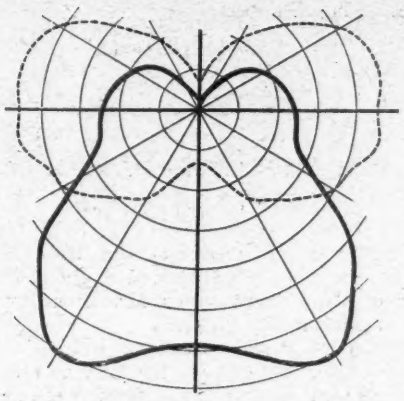

FIG. 6.—POLAR CURVE FOR LAMP FITTED WITH HOLOPHANE SHADE (No. 6046). (Combination III.)

been carefully aged and compared in its working position with a standard carbon-filament lamp. This latter was used for calibration purposes throughout the whole of the

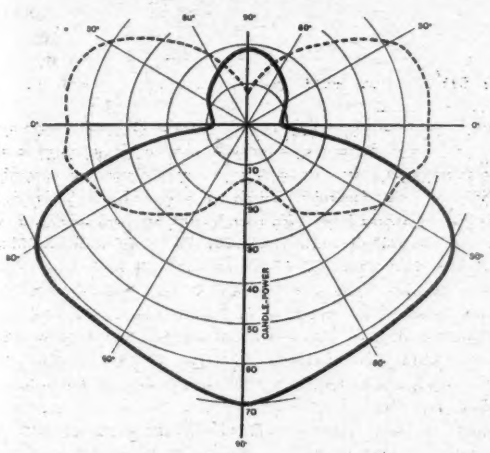

FIG. 7.—POLAR CURVE FOR 10" × 5" CONICAL OPAL SHADE. (Combination IV.)

tests under (*a*) and (*b*), so that the highest possible accuracy might be ensured with regard to the comparative values of the results.

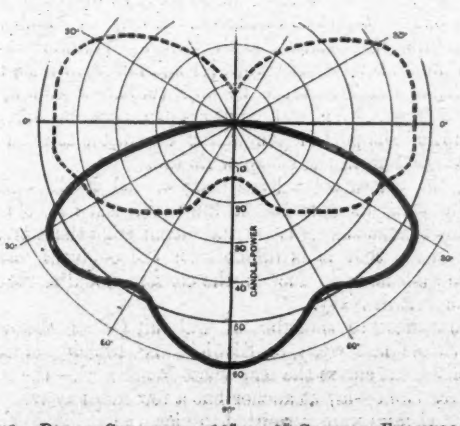

FIG. 8.—POLAR CURVE FOR 10" × 5" CONICAL ENAMELLED-IRON SHADE. (Combination V.)

The lamp used in obtaining all the polar curves was a 240-volt Osram with obscured pip, the power taken being 60·5 watts. The mean spherical candle-power was deduced from the polar curves by Rousseau's construction.

The polar curves corresponding to combinations II, III, IV, V, VI, are shown in figs. 5, 6, 7, 8, 9, while an analysis of the results will be found in Table I.

The photometer was fitted with a Bunsen grease-spot screen, this having been found to be capable of very high accuracy if due precautions are taken with the measurements.

In cases I to V the light sources were fixed and the photometer head moved between them, while in cases VI and VI(*a*) the photometer head was at a fixed distance from the lamp and shade under test and the comparison lamp was moved.

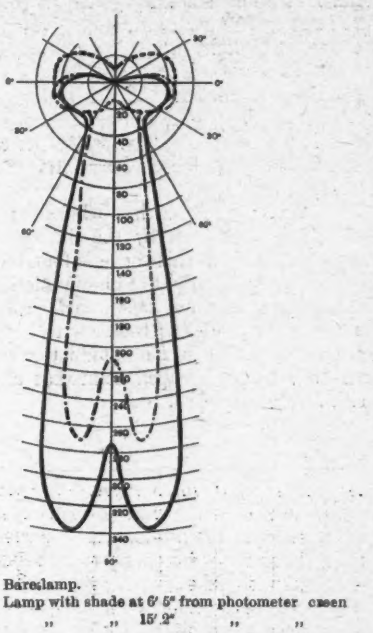

FIG. 9.—POLAR CURVES FOR SILVERED GLASS REFLECTOR. (Combinations VI and VI(*a*).)

The object of the procedure in cases VI and VI(*a*) was to ascertain if the shape of the polar curve would be considerably affected by the distance between the photometer screen and the lamp and shade. It was thought that the considerable focusing powers of some shades might render the assumption of the inverse square law quite inapplicable, and the extent to which

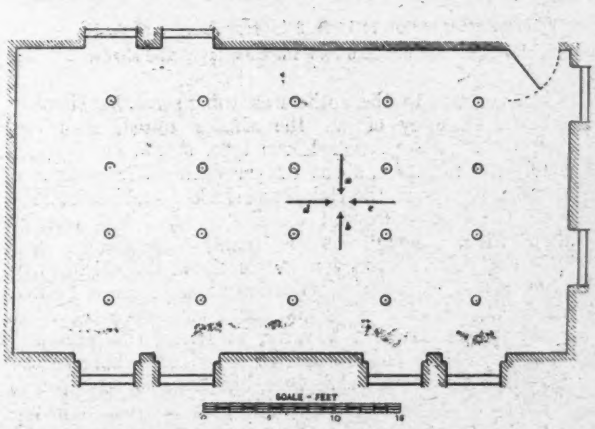

FIG. 10.—PLAN OF ROOM IN WHICH EXPERIMENTS ON DIRECT ILLUMINATION WERE MADE.

this occurs may be gathered by comparison of the full and chain-dotted curves in fig. 9. This, however, is a very extreme case, and there seems little reason to doubt that the inverse square law will become applicable in every case if the photometer screen is at a sufficient distance from the shade, and the distance chosen in cases I to V is probably large enough. It should also be realised that although some divergence will generally arise in the shape of the polar curve when the photometer screen is fixed at a greater or less distance, the mean spherical candle-power, which is a measure of the total flux of light emitted, should remain

unaltered if the experimental work has been carried out accurately.

With each of the polar curves (figs. 5 to 9) the curve referring to the bare lamp is shown as a dotted line, and from this the reflecting effect of each shade may be gathered, and, as a further rough criterion of this reflecting effect the magnification of the downward beam is given in column 6 of Table I, while the efficiency* of the whole arrangement in lumens of total light flux emitted per watt input is given in column 8. The efficiency given in column 9 refers to the bare lamp as 100 per cent., and gives a direct measure of the amount of light which is not absorbed by the shade. It will be observed that the figures given in column 8 depend on the efficiency of the lamp, usually expressed in watts per candle-power, and on the efficiency of the shade as given in column 9. The watts per candle-power for the bare lamp are 1·31 for the horizontal beam, or 1·66 for the mean spherical value.

The high efficiency of the opal shade is somewhat striking, and this is confirmed by the illumination tests described later. A defect in this shade is found, however, in the fact that, when used singly, the illumination immediately beneath the lamp is patchy, but this would probably not have been the case if the shade had been curved or fluted. The trouble was entirely absent in the illumination tests in which a large number of lamps, grouped somewhat closely and at a fair height, were employed.

TABLE I.

(1) Reference No.	(2) Downward candle-power.	(3) Horizontal candle-power.	(4) Maximum candle-power.	(5) Angle of maximum candle-power.	(6) Magnification of downward beam.	(7) Mean spherical candle-power.	(8) Efficiency. Lumens/watts.	(9) Shade efficiency. Per cent.
I*	13·55	46·25	46·4	10° above H	1·00	36·3	7·52	100
II*	84·2	25·0	84·2	90° below H	6·2	29·5	6·11	81·3
III*	59·6	24·75	71·5	62° ,,	4·4	29·8	6·17	82·1
IV*	70·25	8·8	70·25	90° ,,	5·19	29·8	6·17	82·1
V*	61·0	0	61·0	90° ,,	4·5	20·95	4·34	57·8
VI†	273	36·8	338	85° ,,	20·15	29·4	6·1	81
VI(*a*)‡	207	42·25	268	85° ,,	15·3	29·7	6·16	81·8

* Average distance of photometer screen from lamp and shade about 18 ft.

† Photometer screen at 15 ft. 2 in. from lamp and shade.

‡ Photometer screen at 6 ft. 5 in. from lamp and shade.

It also occurs to the authors as being somewhat singular that the efficiency of all the shades tested, with the exception of the enamelled iron type, should be approximately the same, *i.e.*, about 82 per cent. With reference to the polar curves, the Holophane shade (combination III) gives the best downward distribution for most interior illumination, though it is really surprising how little the polar distribution affects either the efficiency or uniformity of the actual illumination when a room is lighted from a large number of points placed sufficiently high. It would appear desirable, however, to reduce the horizontal intensity as far as possible and so to bring the bulk of the light into the lower hemisphere, but there is no apparent objection to casting a considerable portion of the light upwards where a clean white ceiling is available for reflection. This practice has, moreover, the advantages of rendering the illumination more uniform and less productive of sharp shadows, and also secures a more pleasing effect by enabling the upper parts of the room to be clearly seen.

When the upper part of a room is of dark colour, the silvered glass type of shade is the most efficient to use, in that the whole of the light which is not absorbed by the shade may be thrown downwards, and the efficiency is good. The particular reflector tested had a smooth interior and resulted consequently in considerable "patchiness" in the light immediately beneath it, but this disadvantage would not be found if the reflecting surface had been corrugated or prismatic. A reflector of the Holophane type, silvered on the outside, should give particularly good results in this respect.

(*To be continued.*)

* As the lumen is the light flux emitted from a source having a uniform spherical intensity of 1 C.P. in unit solid angle, it follows that the total flux in lumens emitted from any source = M.S.C.P. × 4 π.

THE MUNICIPAL ELECTRICAL CONVENTION, 1911.

IN our last issue we referred at some length to the first day's proceedings of the I.M.E.A. at Brighton, when, owing to lack of time, discussion on Mr. Beauchamp's wiring paper was unfortunately cut short.

One new system of wiring mentioned by him, *i.e.*, "Cab-tire sheathed flexible" cleated on to the wall, appears to possess many points worth discussing at a meeting of this kind, and we refer to it elsewhere in this issue.

The next day's programme was a very full one, commencing with an early journey to Portsmouth, where the morning was devoted to a discussion on internal combustion engine papers by Messrs. Howard and Carr.

The Diesel engine provides a fruitful theme for discussion, and it was generally admitted that as used at present, in small sizes, it gives great satisfaction; the only wonder to us is that it has taken so long for its good features to be practically appreciated.

If we rightly interpreted the remarks of Mr. Day (of Mirrlees, Bickerton & Day) the outlook for the large size Diesel, in connection with electricity works, is not very promising, owing to the mechanical complications and increased cost involved. Mr. Leonard Andrews ably defended the big gas engine, criticising the figures given by Mr. Howard for a 10,000-KW. Diesel engine station, while Mr. Seaton solemnly informed the meeting that he had no idea there was so much trouble with the big gas engine until he attended a recent Manchester discussion, where the room was full of gas engine makers, but the users all seemed to have pressing engagements. Needless to add, the users of steam turbine plant could, and did, quote much lower running costs than the author for the large Diesel plant, and there seems little chance of the large internal combustion engine being adopted by the municipal engineer, at any rate, for some time to come.

The old question of oil fuel supply cropped up, and it was pointed out that the gas tar oil produced in this country is much more than sufficient for the whole of the heavy oil engine demand in this country.

With the conclusion of the discussion an adjournment was made, by car, to a seaside eating-house (?)—of evil memory—where one of the most indifferent 3s. lunches which we can call to mind was inflicted on the party. We, like the coster, could find no "bloomin word for it," and so, at the risk of repetition, must adopt the popular verdict—"rotten," with qualifications. We can only assume that it was a wily attempt on the part of the wiring contractor to exterminate the Association in the prime of its life.

In the afternoon a large party visited H.M. Dockyard, which, with its peaceful looking avenues and old world buildings, is so suggestive of retirement from the activities of this world, that it is difficult for the engineer visitor to realise that he is, in fact, in the constructional headquarters of the British Navy.

We confess to thoughts of Dalmuir (which the Association visited last year), of Elswick, and, perhaps, of another establishment across the sea, whose handiwork—the 27-knot *Von der Tann*—lay at anchor but a few miles away.

The visitors were permitted to view the Belliss-Dick Kerr direct-current generating plant, some 3,500 KW. of which is installed in the Dockyard power house, mostly in 600-KW. sets, also the exterior of the unfinished Dreadnought type *Orion*, with its 10 13·5 in. guns, Britain's last "last word" in naval construction; subsequently we scrambled on to a naval tender for a brief visit to the 20-year old battleship *Revenge*—used as a gunnery training school, a sort of steel *Victory*, which, unlike the old flagship, will shortly pass into the breaker's hands.

The afternoon was more remarkable for exercise than anything else, and a quiet evening was spent in a very pleasant cruise on the Solent, which, unfortunately for the sightseer, had but a few hours previously been denuded of the large fleet which assembled for the Coronation Review; the party returned to headquarters later in the evening.

On Thursday morning the Brighton meetings were resumed at the Royal Pavilion, when lengthy discussions took place on the purchase of fuel, and on street and shop front lighting.

As regards the former subject, probably most interesting were Mr. Chattock's remarks on the systematic coal testing carried out by the Birmingham electricity department, by means of which complete information has been accumulated in regard to 130 different classes of fuel in the Birmingham district, and the average price per ton has been reduced from 8s. to 6s. 10d.

The calorimeter, while, no doubt, a useful adjunct to the boiler house, has not been found essential to success, and not a few engineers pin their faith to practical boiler house tests—pounds of coal against units generated over regular periods—as the only reliable guide for fuel purchasing.

Mr. Frank Ayton incidentally drew attention to the speedy Berthier system (the litharge method) of fuel testing used by the Lot's Road station engineers, instead of the calorimeter—the time taken for a test being 20 minutes; and other speakers pointed out that the purchase of fuel on a heat-unit basis largely depended on the goodwill of the coal owner.

As regards shop front lighting, Mr. Seabrook (Marylebone) mentioned that the West Ham electricity department had been able to keep out the high-pressure gas lamp, while the neighbouring East Ham electrical undertaking, which charged a lower price, suffered from this form of competition; he came to the conclusion that price was not so material, but that West Ham's success was due to its business-getting department.

Mr. Haydn Harrison, who introduced the subject of street lighting, urged that the short loan periods for electric lighting, and the fact that the capital invested in street gas lighting had mostly been paid off, placed the former in such a tight position as regards competition, that a mutual arrangement between the two adversaries—taking Holborn as an example—would be the best way out of the difficulty. The cost came out practically the same for gas and electricity, except for capital charges—which, of course, are heavy in the latter case during the first few years. Mr. Harrison urged, and we would emphasise, the importance of having a share of the street lighting, if only for the advertisement.

It was suggested, however, with some reason, that as street lighting fittings have lasted 10 or 15 years, the L.G.B. might be brought round to a more consistent attitude if pressure were exercised.

Mr. Cramb's proposal that in order to meet the competition of gas in outside shop lighting, the supply authority should run such lighting in connection with electric street lighting, and charge inclusive figures for energy and maintenance, seems quite a good one.

After an adjournment for lunch, visits were paid to the Corporation sub-station at North Street, with its fine array of Westinghouse converting plant, and to the Brighton Railway locomotive shops, which are equipped with some 2,000 H.P. of motors, supplied from the public mains, and apparently give a remarkably steady load. The latter works have been modernised within the last few years by Mr. Earle Marsh, the locomotive superintendent, and now compare favourably with any others of the same kind; they are fully equipped with electric travelling cranes and electric driving—in some cases individual drive—is used throughout. The smith's shop is a model for such establishments, with its independent motor-driven forced draught and exhausting plant.

The visitors were shown the first "Atlantic" type locomotive, constructed by the Brighton Co., nearing completion, a machine similar to those which the company has previously purchased, and which merits some consideration when electrification schemes are in the air; they, no doubt, also envied the small gold mine in the form of copper fireboxes which the company uses in all its locomotives.

The annual dinner of the Association which was held in the Royal Pavilion in the evening, proved a very enjoyable function. The toast list was a short one, and "the chair" commendably brief in its remarks; it fell to the lot of the Mayor, Councillor Thomas-Stanford, to reply to the toast of his Corporation, which he did in an excellent speech, while Mr. Ferranti, as President of the I.E.E., replied for the guests, including the ladies, who for the first time were present in large numbers at the annual dinner.

An excellent musical programme was provided, which to the regret of many, was barely commenced when an adjournment took place to the Grand Hotel for dancing.

Friday morning's business meeting brought the Convention to a close.

After the election of officers and council for the year 1910-11, the annual report was taken as read; we summarise its contents elsewhere. The new council is as follows:—

President: G. Wilkinson (Harrogate). Vice-presidents: C. E. C. Shawfield (Wolverhampton), and R. A. Chattock (Birmingham). Past presidents: S. L. Pearce (Manchester), W. W. Lackie (Glasgow), and J. Christie (Brighton). Engineer members: Messrs. Cramb (Croydon), Long (Norwich), Richardson (Dundee), Ayton (Ipswich), Wyld (Birkenhead), Furness (Blackpool), Seabrook (Marylebone), and Watson (Bury). Municipal council members: Messrs. Bruce (Sunderland), German (Brighton), West (Coventry), Willock (Glasgow), Rowntree (Harrogate), and Crowther (Sheffield). Hon. solicitor: Alderman Pearson (Bristol); Hon. treasurer, J. E. Edgcome (Kingston-on-Thames); Hon. secretary: H. Faraday Proctor (Bristol), as before.

The meeting was of a semi-private character and, in many ways, it would have been better had the Press been excluded from the hearing of what may be termed official secrets, and therefore freely discussed elsewhere by those whose interests are most concerned.

However, we appreciate Mr. Christie's tactful handling of an awkward situation; indeed, to his genial chairmanship is in large measure due the series of pleasant meetings which have been held at Brighton.

Looking back over a number of these Conventions, one is tempted to suggest that an important body such as the I.M.E.A. could with advantage improve its arrangements on such occasions.

For instance, provincial accommodation, and particularly luncheons, leave a good deal to be desired, and it has been suggested that were London the regular meeting place, and we are inclined to the opinion that country members would gladly make for the metropolis, which caters for all tastes, difficulties under these heads would disappear. On the other hand, the division of the members into several parties, each with its own chairman and hotel, would, no doubt, give greater satisfaction all round than the present system of fixing a headquarters and leaving the odd men to shift for themselves in provincial towns.

Coming so soon after the Coronation festivities, the visitors were able to admire the electrical illuminations on the extensive sea front, West and Palace piers, hotels, &c., the Grand Hotel—the Association's headquarters—being the exception, illuminated by gas on a calm night, but in darkness at other times.

In this respect it resembled the headquarters of the local gas company, which however, with the aid of a man and a torch, made brave attempts, between gusts, to show the electrical visitors what gas illuminations should be like.

The Municipal Convention and Wiring.

WIRING questions have been prominent within recent years at the meetings of municipal engineers, and Mr. J. W. Beauchamp's practical paper on "Modern Wiring" is specially useful at this time when some of the municipalities are seriously considering the advisability of instituting their own wiring departments.

Most supply authorities realise that the small consumer in large numbers would be a desirable asset to the central station, and the recent Brighton discussion shows that many consider the initial outlay for wiring to be the chief barrier which now stands in the way of the general adoption of electricity.

In most districts this class of consumer can only be obtained in bulk by the offer of wiring on easy hiring terms, or at slightly increased supply rates, and in those places it will probably pay to accept the burden and risk of such methods for recovery of initial expenditure.

Mr. Beauchamp leaves the question open as to whether the actual wiring could best be done by contractor or supplier; but he suggests, we think rightly, that in the majority of instances, organised schemes for wiring small houses in quantity can be arranged with most effect by the municipality.

The author has not much to say in favour of existing cheap systems, and appreciates the fact that the policy of accepting the lowest tender, for imperfectly specified work, is demoralising. He would seek a system which would be reliable; less costly than present better class wiring; and as capable of easy specification as the standard work of the gasfitter or plumber.

In the search for such a system and to attain desirable uniformity of practice, he would, in a measure, disregard the various existing wiring rules, as he considers that attempts to conform to regulations of the I.E.E., insurance companies, and local authorities, have a tendency to keep the cost of wiring unnecessarily high.

The paper was prepared before the new issue of the I.E.E. Rules, but the author has in several instances anticipated changes from the 1907 Rules—for example, the higher rating of cables as a factor in cost reduction is advocated.

It seems to be the case in wiring that inefficient installations may be in conformity with all existing rules, and good work may be done in almost complete disregard of them. Experiences, opinions and interests differ and clash, local practice varies, and new systems and conditions of supply make entire agreement on uniform standards very difficult. Wiring may perhaps be made more reliable than the work of the gasfitter, but it can never be so simple of specification.

Mr. Beauchamp is in favour of framing yet another set of rules; these to be of a simple and definite character but rigidly enforced. He considers that they should be under the control of someone directly interested in the supply undertaking involved, and not administered by any outside central body. Yet, in view of possible competition with other supply companies, he would have these regulations applied in a flexible manner. Such flexibility would hardly tend to more uniform practice or more reliable work, and contractors, to live, would require to cultivate the friendship of the station engineer more assiduously than ever. The interest of insurance companies in wiring rules appears to have been overlooked.

It may be that municipal engineers, as a class, do not rightly appreciate all the difficulties of proper wiring, and its adaptation to the varying conditions of use and building structure, and many will too lightly undertake themselves—or delegate to subordinates—the task of preparing or enforcing wiring specifications.

The notorious variation in tenders goes to show that many specifications are vague on really essential points, and should warn the public that the preparation of wiring specifications is rightly the work of consulting engineers, who are experienced and expert in this branch of the electrical industry.

To us it would appear that the obstacles to the general adoption of electricity can be most surely overcome by a more orderly advance on the part of the whole electrical army working in harmony and utilising to the full the specialised knowledge of each section. By concentration each section increases in efficiency, and is able more rapidly to adapt its work to changed conditions. It is a disturbing factor when one division seeks to fulfil the functions of another. Municipal engineers, consulting engineers, contractors, and manufacturers each usefully occupy their own field, and it is to the interest of each class to set a boundary to their duties and respect the special knowledge of others. In discussion, the plane on which they mingle should be the higher one represented by the Institution; in trade they ought to co-operate, not oppose one another.

With regard to wiring questions, efficiency as a rule is best attained by employing only skilled labour, controlled by responsible contractors—the contractors working to the specification of experienced consulting engineers, who have duly weighed the special and local conditions, and can give consideration to the interests of the clients, be they owners, builders or suppliers. In the case of repetitive work, such as small houses in quantities, fees are probably best arranged beforehand in the form of low rates per outlet point, the rates being sufficient to cover the cost of inspection of work before it is covered up. Finally, installations all over the country should be brought into conformity with essential rules and tests framed by the Institution. Here Mr. Beauchamp's suggestion of graded sets of rules is worthy of serious consideration. But the real desideratum is yet to seek, namely, a very cheap method of wiring which complies with the best rules and tests.

The pressure at which small installations are supplied varies, but manufacturers have long been making H.V. accessories, and little, if anything, is to be gained by lowering the resistance, or reducing the spark gaps on these. The lower pressures are generally on A.C. circuits, where, owing to their nature and the common adoption of auto-transformers, it is advantageous to have good margins of safety on switches, &c. Manufacturers can influence cost reduction by judicious standardisation of everyday articles, and the standards should have the approval of the Institution. Distinct definitions of carrying capacity are much needed for accessories, as many of the fitments on the market are overrated in regard to this.

Attention is directed to the value of inspection of samples of concealed wiring. In all conduit systems, inspection is simplified if the cables are fitted on the "draw-in" method. The tube runs require more careful planning than is the case with "threading" methods, and the cables themselves have less handling, and are likely to last longer as the plaster may be allowed to dry before wires are put in place.

In the brief comment on this paper, in our last issue, we referred to wiring through joists—suggested by several speakers. We do not consider that the ideal cheap system is to be found in this direction. The method was much used in America at one time, but is now almost abandoned, although the greater use of wood in building construction was more favourable to its adoption there, than is the case in our brick and lime buildings with soundproof floors. Such a system can only be fitted with reasonably low labour costs on new buildings, before floors are laid, and very excellent cable insulation is required to withstand the after labours of the carpenter and plasterer.

With regard to earthing, the author notes the importance of grading the earth connections to sustain the main fusing current without appreciable temperature rise.

On systems where the apparatus and tubes are not continuous, a substantial earthing wire or tape running throughout the installation is proposed. Again, it is suggested that in systems where slip sockets are used, only those portions which are in wet situations should be earthed and the remaining lengths isolated by insulating couplings, further protection against corrosion and accidental contact being provided by brading the external surface of the tube lengths. Situations occur where these methods may be applied with advantage, but they are not so common in small installations, and we consider that as a general rule it is preferable to make the metallic sheath electrically continuous throughout. To insulate the outside of tubes adds to the cost, the external insulation may retain dampness, and in nearly all buildings it is not difficult to arrange local insulators between conduits and structural metal work or gas pipes. It is right to emphasise the importance of avoiding contact with such metal work, the dangers of which are often overlooked by wiremen, or the bellhanger or gasfitter who follows the wiremen. Such harmful contacts can only be effectively tested for, however, if the conduit is quite continuous electrically.

We are attracted by the proposal to encourage the use of flexible armoured systems for heating requirements. The heating circuits in small houses are simple, and the outlet points being near floor level enable one to adopt surface wiring without offence. Much of the objection to install "heating" is overcome if the tenant gets a system which he can take with him when removing to other premises.

It is apparent from the foregoing, and more evidently so from the more detailed report of the paper and discussion given elsewhere in our columns, that rules for wiring can deal only with general principles, and that no simple specification can be made applicable to the varying conditions of practice.

A gas stove on rental can be removed if the tenant or his

successor declines to use it, but not so with electric wiring. It may be possible to devise a sound system of surface flexible wiring radiating from one centre to each light, and capable of easy removal. An alternative and better method would be to make the house owner permanently responsible for the house wiring, and collect the rental from him. In the latter case it might be necessary to use better cable than indicated in Mr. Beauchamp's table of costs, otherwise, by the time the owner had paid for the installation, its useful life would be at an end.

Modern Wiring Practice.

By J. W. BEAUCHAMP, Chief Electrical Engineer, Tunbridge Wells.

(*Abstract.*)

IT is the object of the writer to draw attention to the features of modern wiring practice and regulations in so far as they influence the cost of small installation work.

To enforce regulations in detail, without obstructing work and progress, is a comparatively expensive matter, requiring experienced and conscientious inspection and a decided sense of proportion on the part of the inspector. The proper course appears to lie in drafting simple and definite rules dealing with :—

1. Safety of the consumer.
2. Non-interference with the proper working of the supply to other consumers.

The requirements of these regulations to be made as light as possible, but the enforcement of them to become more stringent.

A change in this direction should secure greater uniformity of work, tending to lower the cost of high class wiring and force up the quality of the lower class work, as in the latter almost all the trouble arises from insufficiently skilled labour; the employment of competent and full priced wiremen would frequently reduce the prime cost of jobs, and save good material from being reduced to a secondhand condition before it is even put to work.

Simple model specifications issued by the supply authority describing the requirements of good practice suitable for several different classes of wiring work would do much to render practice and prices more uniform. In any case, in view of the rapidity with which electrical practice changes and the fact that so much of our work is secured in competition with other systems of light and energy supply, it is undesirable that wiring regulations, however simple, should be administered in an inflexible manner, or pass under the control of any centralised body not directly interested in the commercial development of the supply undertakings involved.

An analysis of the published regulations of a number of British and foreign authorities controlling or advising upon electrical work shows how great a divergence exists in their requirements, and suggests that, even after allowing for climatic differences and local conditions, the cost of wiring must be affected considerably by the varying limits imposed.

The usual I.R. test depends more upon dryness of the building and care used in connecting up fittings than upon the actual resistance of the dielectric, and a fair result may be obtained from wiring which has suffered considerably by careless workmanship and may be doomed to early failure. For these reasons, a much lower I.R. than is usually called for would suffice, but should be supplemented by inspection of samples of hidden work in every case.

The limits of capacity of branch circuits vary from 2 to 15 amperes; it would appear that the true limit lies in the ability to make proper current-carrying connections in the various "loop-in" fittings used on branch lighting circuits; 10 amperes should be a workable maximum.

The limit of motor capacity which may be connected to one side of a three-wire system ranges between 1½ and 9 KW.; these limits should depend upon the capacity of the system; in some cases most stringent regulations are issued by very large undertakings.

The motor starting current maximum is best stated in "limiting amperes" for any motor on a system or district, according to the capacity of cables or transformers.

Amongst several existing provisions which now seem curiously out of date are the following: Motors to be insulated; no installation to have less than two branch circuits; no copper fuses to be used; S.P. switches to be used on each main; meter shunt wire to be taken to lamp side of consumer's main switch; slip conduit prohibited; metal conduit to be avoided if possible.

A few, however, are conspicuously in advance of the period when they were written—for example: Bathroom lights to be out of reach of persons in water; tubes and frames to be continuous and well earthed to waterpipes; no elbows to be used in conduit; no single wires to be used, and none less than 3/22's; the use of key socket holders to be restricted; internal lighting fittings to be insulated; meter main coil and all S.P. switches to be on live side of supply (this provision should be tested for and insisted on in all cases).

The Government Regulations of the South African Union recommend that all conduit and fittings should be out of reach of persons standing in or on the bath, or on a wet floor, and that porcelain switches should be used and key socket holders avoided; such a regulation has much to recommend it.

Several regulations in the more modern codes could be made general with advantage, *e.g.*: Electric irons to have some indicator showing when current is on; capacity of cables for motors to be calculated on basis of short-period overload ratings, and on basis of starting currents; key socket holders in groups of not more than eight to be controlled by one separate switch; (one lamp of each group might have a plain holder, when the burning of that lamp would indicate that the control switch was "on").

In addition, a distinct definition of current-carrying capacity for switches and fuse fittings is needed; most modern patterns fulfil every requirement with regard to breaking circuit, but are greatly overrated so far as concerns their power of carrying full-load current continuously.

Earthing Regulations mostly fail to define the essential requirements for security from risk of shock or fire, which are that every part of a metallic sheathing or conduit system containing conductors shall be permanently connected to earth by a conducting path of sufficiently low resistance to carry, without sparking or heating at any part, the maximum current which the main fuses of the installation will pass.

The earth wire also, whilst requiring a definition of minimum size for reasons of mechanical strength, should have a stated size depending on the capacity of the installation; the minimum might be No. 18 S.W.G. The sizes used should bear a relation to the main fuses, or circuit-breaker setting, of the system protected, being selected to carry the full current required to open the circuit without appreciable rise in temperature. Where local circumstances require the earthing wire to be of considerable length, its area should be proportionately increased. As an example of safe practice:—For all lengths up to 20 yards, and current up to 50 amperes, No. 18 S.W.G.; up to 100 amperes, No. 14 S.W.G.; up to 250 amperes, No. 12 S.W.G.

The earth connection can be tested at intervals from different points of the installation by taking an ammeter reading between it and the live poles of the wiring through a small known resistance. The readings will show up any change in the state of the earth connection and prove its energy discharging capacity in a way which tests with a bell or lamp do not do.

It is desirable to avoid connection to girders and constructional ironwork, which is often insulated by concrete, and even if it appears to be well earthed, may be so through gas or other pipes making variable contact, and subject to removal; to gas pipes of any kind; to hot water and hydraulic supply pipes, as they are often jointed with imperfectly conducting material or are only connected to a water supply system through a tank and ballcock; to water pipes drawing supply from cisterns fed by ballcocks, or from wells, as the connection may be broken by lowering of the water level below the delivery or suction pipes; to other earth connections provided for telephones or bells, as these may increase in resistance or provide an alternative path through the instruments to other earths.

In an ordinary house wired with slip-joint tube, a leakage current occurring at any point at all remote from the service entry will probably have to run the gauntlet of sundry loose connections under floors and behind lath partitions on its way to earth. Undoubtedly these considerations present one of the gravest objections to the simpler systems of metallic conduit. Some device is needed to protect concealed wiring mechanically without involving the danger of spreading a leak, or the difficulty of furnishing a completely earthed sheath.

It would seem worth while to consider the extension of the principle of I.E.E. Rule 46 (1907 Ed.), earthing only portions of tube within usual reach in wet places, and keeping the remainder in isolated single lengths by the use of fittings and sockets which actually insulate instead of partially connecting as at present.

The principal weakness of the earthing precaution lies in the fact that it is not essential to the working of the installation, and the wires and joints upon which it depends may suffer damage without the fact being revealed until they fail to give the expected protection.

The first test of a good-class slip conduit lies in the interchangeability of the tubes and fittings and the possibility of making firm metal-to-metal joints at all points after removing the enamel. One of the reasons for using inferior conduit on low grade work lies in the fact that fittings are an easier fit and more rapid erection is secured, at the expense, of course, of continuity.

One of the greatest safeguards for the consumer lies in the use of correctly proportioned fuses, and, where possible, the cartridge form or the modern development of the old Edison screw plug fuse, such as the "Zed" and "Dial" fuses should be used. Consumers should be provided with simple information with regard to fusing, as it is not possible to prevent untrained persons from replacing blown fuses. The supply authority could well take this matter up by using printed cards to be fixed by the service cut-out and the distribution boards, stating the usual fuse sizes rendered in terms of lamps and wire gauges.

The metallic-filament lamp has led to a very general use of pressure-reducing transformers on A.C. distributions over 100 volts, and in some cases also on direct-current supplies where the importance of the installation has justified the use of rotary transformers. The use of low pressures has not apparently made much difference to wiring practice, nor has it become general to use material of lower insulating quality on new work where pressures of 50 to 100 volts are intended.

Small transformers are responsible for a considerable number of faults on consumers' premises, particularly where their cores and frames are connected to earth.

It is somewhat unfortunate that suppliers have not endeavoured to keep control over house transformers by a rental system, which would have done much to keep up quality and avoid troubles which have arisen from improper selection of voltages, errors in connection, and waste through excessive magnetising consumption.

B.C. holders, used for lamps hanging below the holder, will carry 2 amperes (400-C.P., 200-volt, metallic lamps) without trouble, and 1¼-ampere radiator lamps (250-watt, 200 volts) with holder beneath the lamp. Where, however, heating lamps are hung downwards, trouble may arise owing to the concentrated updraught of hot air. The percentage of holders called upon to carry more than 1 ampere (100-C.P., 100-volt, metallic lamp) is quite small, and some modification of the plungers and springs for such purposes should not be difficult to arrange.

The most important recent development in wiring appears to be the re-introduction of the concentric principle in the form of the "Stannos" wiring system. This material is now well known, and where it is possible to work on the surface of a building and use concentric conductors with the outer or return sheath earthed, a saving in cost of 10 to 15 per cent. over slip-joint conduit wiring can be secured by means of it in the hands of men accustomed to its use. As the superior economy of this system over conduit is only apparent when the wire is used concentrically, it has so far been most successful on alternating supplies, where the use of a transformer affords a ready means of isolating the consumer's wiring from the supply network; as such transformers may also be used to reduce voltage, their cost is not altogether chargeable to the concentric wiring.

The great value of this material lies in the fact that faults quickly develop into short-circuits and put the bad section out of use, whilst repairs are easily carried out; in addition, all the simplicity and advantages of a single-pole system are secured.

Flexible Wiring has been much discussed from time to time, but no effort made to define its utility or to establish any regulations which might make it safe for certain classes of work without rendering it too expensive; in consequence, a considerable amount of such wiring is actually in use in this country, the material being used in a most improper manner, and only saved from failure by its high quality. A heavy armoured and fairly flexible cord to carry up to 10 amperes without overheating, and provided with good plug terminal fittings and fuses of the cartridge type, might reduce the first cost and consequent difficulty of inducing users of electric light to put in heating and cooking apparatus; such wiring could also be a tenant's fixture capable of removal to, and use in, other premises.

A disadvantage peculiar to all fixed surface-wiring systems lies in the difficulty which is met with when redecorating walls and ceilings, particularly when papering. This fault is sometimes lost sight of by those who advocate such systems on the grounds that existing decorations will not be injured.

The influence of the system of wiring adopted upon cost is indicated by the following figures, which, although actually variable according to circumstances, are relatively representative of the principal methods available for wiring small houses. On the cheaper systems labour costs become a much smaller proportion of the total, suggesting that it is only under some organised scheme of wiring houses in quantity, such as might be arranged by a supply authority, that the fullest economy of these methods can be realised.

RELATIVE COST PER LIGHT OF WIRING IN SMALL PRIVATE HOUSES COMPLETE WITH METALLIC LAMPS AND SIMPLE PENDANTS.

	Percentage of No. 1.		s.	d.	Per Light. £	s.	d.
Screwed seamless conduit (steel) and 600 meg. class non-association cable.	123	Conduit ...	5	9	1	2	6
		Cable ...	5	9			
		Fittings ...	5	9			
		Labour ...	5	3			
Brazed slip conduit with clamp continuity fittings.	116	Conduit ...	5	6	1	1	3
		Cable ...	5	9			
		Fittings ...	5	9			
		Labour ...	4	3			
Brazed slip conduit and 600-meg. class non-association cable.	107	Conduit ...	4	0	0	19	6
		Cable ...	5	9			
		Fittings ...	5	9			
		Labour ...	4	0			
Brass-cased paper tube ...	104	Tube ...	3	6	0	19	0
		Cable ...	5	9			
		Fittings ...	5	9			
		Labour ...	4	0			
No. 1.—Close joint slip conduit (steel) and 600-meg. class non-association cable.	100	Conduit ...	2	9	0	18	3
		Cable ...	5	9			
		Fittings ...	5	9			
		Labour ...	4	0			
Wood casing and 600-meg. class non-association cable.	96	Casing ...	1	3	0	17	6
		Cable ...	5	9			
		Fittings ...	5	9			
		Labour ...	4	9			
Stannos wiring (concentric).	71	Cable ...	6	3	0	13	3
		Fittings ...	5	9			
		Labour ...	1	3			
Twin rubber and lead-covered cable.	71	Cable ...	6	3	0	13	3
		Fittings ...	5	9			
		Labour ...	1	2			
Rubber and cotton flexible and button insulators.	70	Cable ...	5	9	0	12	9
		Fittings ...	5	9			
		Labour ...	1	3			
600-meg. class non-association cable and cleat insulators.	57½	Cable and insulators	3	6	0	10	6
		Fittings ...	5	9			
		Labour ...	1	3			

DISCUSSION.

A brief discussion took place on this paper.

MR. S. E. FEDDEN (Sheffield) said that his department had little trouble in getting houses of £30 per year rental, providing they were not piped for gas, and even smaller houses might be secured if the builders' co-operation were obtained. While not an advocate of jerry wiring, he thought it necessary to practice economy, and many features of the wiring regulations would have to be modified if the small consumer was to be connected. Even where a carefully considered installation was put in, the consumer added indiscriminately to his load. It was a great pity that installation work in so many towns was in the hands of contractors; the consumer wanted sufficient light at a reasonable cost, but the contractor's idea was to supply as many lamps and fittings as possible. His mistakes had to be rectified by the supply authority, who were often blamed for them in addition. He had always believed in the 200-volt lamp, and did not favour pressure reduction; in Sheffield there were cases where the use of auto-transformers had increased, instead of decreased, the consumers' accounts, and the Corporation had had to replace the transformers owing to their excessive magnetising losses. As to Stannos wiring, it was too expensive; a certain job for which estimates were prepared came out as follows:—With wood casing and 600-meg. cable, £35; with I.M.E.A. "flex," £35; with Simplex steel armoured "flex," £41 10s.; and with Stannos concentric, a double-wound transformer and earthed outer, £42 10s. He did not like either slip joint or the more expensive screwed conduit, but had not found a substitute.

MR. F. M. LONG (Norwich) said that 14 years ago they started free wiring of small houses of £10 to £15 rental, and he found that most of the troubles were electrolytic, and not due to overloading; as these only occurred in damp places, it was necessary to adopt suitable wiring. The general practice was to attach the wires to the joists, and this was found satisfactory. In new houses close joint tubing in the walls was used, but solid tubing was more satisfactory; pure rubber flexible, though rather more costly, was preferable to vulcanised.

MR. W. A. VIGNOLES (Grimsby) thought that more attention should be given to wiring on easy terms, and that everyone should have power to carry out such work. All slip joint systems of wiring were bad, as it was not possible to make them mechanically continuous, and the clips were often missing. The system they had found most economical was to use two single lead-covered wires, run through holes in the joists, with wires to switches in tubing in the walls. He had found paper-insulated lead-covered cable satisfactory in large installations. Earthing was an important point, where there were gas pipes; in concluding, he drew attention to the use of the double-wound transformer on A.C. systems, with pressure reduction to 25 volts, and no fuses on the L.T. side.

MR. FRANK AYTON (Ipswich) advocated the use of wood casing, which in damp situations, should be supported on insulators and coated with waterproof paint. In his opinion switches should be rated on a wattage basis and an endeavour be made to standardise ceiling roses and switch blocks for wiring positions, also wall plugs and sockets, which were not interchangeable though nominally the same size.

MR. A. J. CRIDGE suggested the necessity of using some discretion in enforcing wiring regulations; and owing to lack of time MR. BEAUCHAMP decided to communicate his reply to the proceedings.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Notice to English Firms.

In your issue of last week you have a letter under the above heading from T. O. Mullings, engineer in charge of the Electric Light Works, Mansourah, Egypt, which apparently refers to myself. After returning from Egypt, I travelled for an electric lamp firm on commission (being an old telegraph and electrical engineer, *too old at* 40) this being the only way to earn a living. As this did not pay me, I applied to other General Electric Manufacturing firms for employment, but got reply that they had no vacancy for a traveller. In course of conversation with these firms, and as I had been both in Egypt, India and other countries, I was asked could I give the names of any buyers of electrical plant. Naturally I did so, and as all managers want new business I suppose they wrote to these addresses—Mr. F. T. Murdoch, the proprietor of the Mansourah Works, being one of them. I was asked could they use my name. I replied that it would be useless, as although I knew most of them personally, I had *not had* commercial dealings. So you see it was purely a business affair of no benefit to me except that they promised, in the event of their getting orders, they would make me a present as commission.

I am now travelling for the firm T. O. Mullings refers

to, and in course of my occupation I wrote to Mr. F. T. Murdoch (Mr. Mullings's *employer*) asking for orders for our goods—*is there harm in this?* I should think Mr. Mullings would be only too glad to get a list of various firms' prices without grumbling and trying to injure an innocent person.

Moreover, Mr. Mullings is untruthful, as both his employer, Mr. Murdoch, and himself have on several occasions been in my company. In fact, I have letters from Mr. F. T. Murdoch since leaving Egypt—and again I did not state I worked for him, but had been employed in Egypt, &c., and at Mansourah, and knew them, which is a fact.

In fairness to myself, I trust you will kindly insert this in your next issue.

Wm. O. Rogers.

Bradford, *July 1st*, 1911.

Diversity of Tariffs.

I wish to draw your readers' attention to the present diverse methods of charging for current used by motor-generators supplying projection arc lamps in connection with cinematograph machines.

At present my company has 12 machines running from 12 noon until 10.30 p.m., and the cost varies from 3¾d. to 0·875d. per unit. In two cities we are charged at full lighting rate because the authorities state that the ultimate use of the power is the production of light. Our reply to this is :—

(*a*) The projection arc is the apparatus by which we carry on our business, and, from our point of view, more essential to us than a lathe in a machine shop or a circular saw in a timber yard.

(*b*) The load factor is a good one—45 per cent. to 50 per cent.—and therefore for this reason alone the current should be cheap.

(*c*) An electric arc furnace undoubtedly produces light, but we have never heard of one being charged at full lighting rate when taking current from a public supply.

In conclusion, I may mention that in one city where the supply is single-phase A.C., we have an auto-transformer installed as an emergency standby for the generator, and the current to motor-generator is charged at power, while that consumed when the transformer is in use is charged at lighting rate.

Is this consistent with business principles?

Provincial Cinematograph Theatres, Ltd.,
RONALD GRIERSON, *Engineer.*

London, W., *July 3rd*, 1911.

Advantages of "Free Wiring."

The objections raised by Mr. Goody to "free wiring" are quite in order on the system he has mapped out, but it must be remembered that all systems are not alike, and the difference between them gives one an opinion quite contrary to his. For instance, there is the municipal undertaking supplying electricity, also the independent supply authorities, and the difference between these alone makes the difference of opinion.

The system adopted here is :—Three points are wired in any house complete with tungsten lamps (from 25 to 100 C.P., as desired), and opal shades on a payment of 5s., and energy is supplied at 6d. per B.T.U. (5d. per unit being the ordinary charge), with no meter rent or any other charges ; the tenant is held responsible for the lamps, &c., and to put them in thorough repair when leaving the house. Should extra lamps be required, for instance, in bedrooms, &c., a charge of 6s. each is made, which covers nearly 75 per cent. of the cost of same, as will be seen.

A trial of the above system was made last summer, which generally is a slack period to permanently-employed wiremen, and about 70 houses have now been fitted with an average of four lights each.

Taking the average cost of installing three lights using 40 ft. of 1¾-in. casing and capping, 20 ft. 1½-in. c. and c., 30 yd. 3/22 cable, six 3½-in. round teak blocks, one 6 × 6 block, three ceiling roses, three tumbler switches, three holders s.c. and c.g., two cut-outs, three tungsten lamps, three shades 8-in. opal, one D.P. switch, 2 yd. flex 35/40, labour and accessories, the cost works out to £1 8s. 4d., including the fixing of the meter and main cut-outs ; out of this 5s. has been paid, leaving 23s. 4d., not including the meter, mains and fuses.

The supply to houses is effected by aerial lines run parallel to the street ; two swan-neck insulators are screwed into the nearest pole, and two insulators are cemented into the wall. A No. 12 hard-drawn copper-wire forms the mains to the wall insulators, from which insulated wires are taken to the cut-outs ; in many instances one pair of mains serves two to three customers, and in this way as many as a dozen or more customers are connected up in two days. The first day the insulators are cemented into the wall, and the next the wires are run, two men being employed on mains. New houses are piped and the conduit is laid in the plaster ; in fact, there is absolutely no difference between these customers and the one who pays for his wiring, as regards the system of wiring.

The advantages of the system are many. The light has been brought within reach of the labourer ; he is, as is generally the case in a colliery district, either a chairman, member or deacon of some committee, club or public institution, therefore he has a voice in the matter of lighting should it come his way, for he has tried it with very little cost to himself, and at the same time is a customer one would rather have than lose. It is the most economical light he can use, getting 5¼ hours' light from a 32-watt lamp for 1d., the price of gas in this district being 4s. 3d. per 1,000 cb. ft. The gas company here have a "free installation scheme," supplying three points with inverted mantles, and a cooking range ; the price of gas is raised to 5s. 6d. per 1,000 cb. ft., no meter or cooking range rent being charged.

The gas company have carved their way to success by this method, and it is now left for us to follow on the same lines, for we can do no better ; but the greatest drawback to us lies in the excessive price charged for prepayment meters, namely, from £3 10s. to £4 10s. each, exceeding the cost of wiring for three lights by over 200 per cent., the extra charge levied of 1d. being more for the payment of the meter than the wiring ; therefore, unless the meter makers can turn out as cheap and reliable a meter as the electrolytic type, I shall content myself with using the latter.

A. Preston, *Electrical Engineer.*

Ammanford Electric Supply,
Carmarthenshire, *June 26th*, 1911.

Appointment of Meter Tester.

I should like to draw your attention to the above notice in the "Situations Vacant" column in the current number of the REVIEW.

I submit, Sir, that from the purely business point of view it is bad, from the moral standpoint it is simply scandalous, to ask for a *competent* assistant to do *responsible* work, of the order they require, for 26s. per week !

If the notice means what it says, it also means that the Stoke-on-Trent people will not find anybody in their own district who is *competent* enough to do the work ; is then a man to come from the ends of the earth—and to live in digs—for 26s. weekly ?

With regard to the moral aspect, words fail me ; something is evidently very wrong with the electrical industry (or its chiefs) to countenance such a thing.

I should hope and think that the people concerned will feel ashamed of themselves when they read their own advertisement, together with the one immediately underneath it.

Responsible Meter Tester.

Birmingham, *July 3rd*, 1911.

Electrical Fatality.—Early in June a watchman, named Wilkins, employed by the Victoria Falls Power Co., was killed while cleaning in a high-tension chamber. Part of the station was dead and part alive, and somehow or other the deceased got his foot inside the live Section ; the sole of his left foot was burned away.

LEGAL.

National Telephone Co., Ltd., *v.* the Postmaster-General.

The Court of Appeal, consisting of the Master of the Rolls and Lords Justices Farwell and Kennedy, on Wednesday of last week delivered a considered judgment in this case upon the cross appeal of the parties from a decision of the majority of the Railway and Canal Commissioners.

The Master of the Rolls, in giving judgment, said: The appeal depended upon the true construction of what was known as the purchase agreement of 1905. The effect of the agreement was that on or as from December 31st, 1911, the company was to cease to transact any telephonic business within the monopoly, and the Postmaster-General was to purchase, subject to certain exceptions, all the property of the company in or as on that same date. The Railway and Canal Commissioners were to settle any differences as to the exceptions and also the value as on December 31st, 1911, of everything purchased and not within the exceptions. It would be observed that all plant, land and buildings in use at the date of the agreement of 1905 were to be purchased on December 31st, 1911. But plant subsequently acquired by the company was only to be purchased if it was constructed in accordance with a scheduled specification, and land and buildings subsequently acquired were only to be purchased if acquired or constructed with the consent in writing of the Postmaster-General. It was part of the arrangement that the Postmaster-General should have the right to object to buy certain property which would otherwise fall within the terms of Clause 2, provided he gave notice 12 months beforehand, and the Commissioners were six months beforehand to award whether the objections were capable of being maintained. The Commissioners were also on, or as on, December 31st to ascertain the value of the purchased property in case of difference. This part of the arrangement was found in a clause which it was necessary to read carefully:—"In the case of (*a*) plant not constructed in accordance with the specifications and rules set forth in Schedule 3, and (*b*) plant of any kind, land and buildings in use on January 1st, 1911, for the purposes of the company's licensed telephonic business in competitive areas, the Postmaster-General may, by notice in writing given to the company not later than January 1st, 1911, object to buy such plant, land or buildings as he considers will be unsuitable for the actual requirements of the telephonic service of the Post Office on December 31st, 1911." It would be observed that the right of objection to plant on the ground of construction under (*a*) was without limit of locality, whereas the right to object to plant, land and buildings under (*b*) was limited to competitive exchange areas, a phrase defined in Clause 1. It was plain that, although (*a*) was wide enough to include competitive as well as non-competitive areas, in practice it must be confined to non-competitive areas. It was also plain that the words "plant of any kind" in (*b*) comprised all plant mentioned in (*a*), including the scheduled list plant. The battle in this Court had raged around the word "unsuitable." He agreed that the primary meaning of "unsuitable," apart from the context, was unsuitable in nature or quality. But that word did not stand alone, nor was it, in his opinion, the most important word in the sentence. It was not the same thing as unsuitable for use in the telephonic service by reason of its character or nature. The word "actual" confined the gift of prophecy to what would happen on December 31st, 1911, and forbade speculation as to what might happen at a more remote date. In his opinion, the meaning of the clause was reasonably clear. It dealt with the case of a competitive exchange area where the Post Office had already, or probably would have, a service in full operation. If the P.O. had in that area adequate provision for the needs both of the company's subscribers in that area and of its own subscribers in that area, the Postmaster-General was entitled to say, 12 months beforehand, "I shall not want this on December 31st. All the requirements of my service will be satisfied without this; it is not suitable for my requirements." The circumstance that (*b*) was not confined to plant but extended to land and buildings, seemed to strengthen the argument that the expression ought not to be narrowed so as to apply solely to nature or character. There were other indications in the agreement which confirmed his view, especially Sub-Sec. (*b*) of Clause 3. That sub-section dealt with plant constructed during 1911 and with buildings constructed or acquired during 1911, and such plant must be in accordance with the specification, or there would be no objection to purchase under Sec. 2 and by it a right to object to three months after December 31st was given. And the question for the Commissioners was to be "suitability of the plant for the actual requirements of the telephonic service of the Post Office on December 31st 1911." It seemed to him that these words could not be limited to nature and character for *ex concessis*, the plant was free from objection on that score. It was not easy to understand why (*b*) was limited to competitive exchange areas on any other view. In such cases there would obviously be a danger of duplication and of superfluous plant and buildings—a danger which would not exist to the same extent in non-competitive exchange areas. He had not overlooked the fact that (*b*) did not apply to all places in which competition existed, but was limited to 15 named competitive exchange areas. These were most important areas, and the parties were content to deal with them separately and apart from the rest of the country. With great respect to Mr. Justice A. T. Laurence, with whom Mr. Gathorne Hardy concurred, he thought he gave too narrow a construction to the words "unsuitable for the actual requirements of the telephonic service of the Post Office on December 31st, 1911," and he agreed with the opinion of Sir James Woodhouse on this point.

The next question for decision arose upon Sub.-Sec. 2 of Sec. 3. The scheme of that clause was that the Postmaster-General was to give notice in writing of his objection before 1911. If the notice was not acquiesced in by the company, the company must obtain an award from the Commissioners before June 30th, 1911, that the property specified in the notice was suitable for the actual requirements of the telephonic service, otherwise the objection was to be deemed valid. Now, as the notice of objection must be given in 1910, 13 months before the subject matter of the purchase could be ascertained, it seemed to him impossible to contend that the notice must specify every detail. It must be sufficient to indicate in general terms the nature of the property to which objection was taken. For example, all plant falling under a particular description, attempting to give particulars of the place in which such plant will be found, or the quantity of such plant, it would be for the company to apply to the Commissioners for an award that the objection was wholly bad or partially bad. Sir Alfred Cripps put forward as an example a cable containing several hundred wires, some of which only were used for licensed telephonic business. The company might contend that such a cable was in use for the purposes of the private-wire business, and that the Postmaster-General was bound to purchase it because the wires could not practically be severed. The Commissioners would decide one way or the other, and the cable would either be excluded from the purchase or not according to their decisions. He expressed no opinion on this point. The decision thus given would govern all similar cases, and there would be no difficulty in applying the principle to the very numerous items in existence on December 31st, 1911. He felt no doubt that a general notice such as he had indicated was perfectly good. It was not made bad because it might include items which could not be properly objected to. In his opinion all the notices were good in this sense, namely, that unless the company obtained an award in their favour, either wholly or in part, the property falling, on December 31st, 1911, within the category objected to, would be excluded from purchase. The opinion of the Postmaster-General expressed in the notice was, *primâ facie*, decisive, and the burden was thrown upon the company as challenging that opinion. It was obvious that questions of difficulty must arise. But he felt confident that the decision by the Commissioners of a comparatively small number of typical or test cases would dispose of these questions, and that with few exceptions the highly competent experts on both sides would agree to details without appealing to the Commissioners in their character as valuers under Clause 4 of the agreement after December 31st, 1911. With great respect to the learned Judge, he was unable to agree with his view as to the invalidity of the major part of the notice. His Lordship added that, in his opinion, the declaration contained in the order of May 29th, 1911, should be discharged and the following order substituted:—Declare that the words "unsuitable for the actual requirements of the telephonic service of the Post Office" in the purchase agreement do not relate solely to the nature or character of the plant, land or buildings. Declare that the fact that plant, land or buildings will not be actually required for the telephonic service of the Post Office on December 31st, 1911, owing to possession by the Postmaster-General on the said date of other plant or buildings adequate and suitable for the actual requirements of the telephonic service of the Post Office on that date, is a valid ground of objection by the Postmaster-General within the meaning of the purchase agreement. Declare that the above declarations are applicable only to competitive exchange areas as defined in Clause 1 of the purchase agreement. Declare that all the notices of objection given by the Postmaster-General were valid and sufficient."

The Lords Justices delivered judgments to the same effect, and the appeal of the Postmaster-General was therefore allowed with costs, and the cross appeal of the company dismissed with costs.

Canning & Co., *v.* Northern Metallic Flexible Tube Co.

(*Concluded from page* 1033.)

Mr. Waugh, K.C., opening the defence, said that plaintiffs had not made a machine of this nature before. The defendants agreed to purchase a plant which would do its work, and not an experimental machine. Plaintiffs' plant did not fulfil this expectation. Previously to its installation, defendants had never received complaints from customers about their flexible tubing, but now there was nothing but a succession of complaints, because the strip oxidised and rusted. If it were proved that orders ceased to come because of the unsatisfactory work of the apparatus, it would be for the Referee to consider what damages defendants were entitled to.

Mr. Albert Crowther, trading under the name of the defendant company, said he had been engaged in the manufacture of flexible tubes for some years. It was necessary to galvanise the steel strip used in this tubing in order to prevent rust. He decided to do the galvanising on his own premises and approached plaintiffs with a view of having a galvanising plant installed. A contract for £230 for a plant was submitted. The machinery was put down, but he never succeeded in producing saleable strip from it. Plaintiffs tried to do so themselves, but failed also, and eventually took it away, after an arrangement that the dynamo installed should be retained, but the rest of the plant renewed. Plaintiffs asked £350 for the second plant, but defendant refused to pay that sum, because he said the failure of the first plant had occasioned him considerable loss. Eventually it was agreed that the price should be fixed at £260. After its erection, the plant did not run properly. Eventually he wrote to the plaintiffs, stating that the plant would never be a success until the iron and lead vats were replaced by slate vats and the terminal winders lined with wood. Not obtaining satisfaction, he refused to pay the

balance of the contract price, and the present action was commenced. Since he had had complaints about defective strip, owing to the inefficiency of the machine, he had lost orders, some of his customers having ceased to deal with him altogether.

Cross-examined, WITNESS said he was the sole partner in the defendant firm. He admitted that he had only taken up the galvanising branch of his business during the last four years, and did not profess to be thoroughly competent at it. He knew nothing about electric currents, &c., when the plant was installed. He denied that he worked the machine with damp sawdust. The machine ran with a varying speed instead of an even drive, with the result that at times the strip passed through the sawdust so quickly that it was not properly dried. The bad colour of the strip was not due to the inefficient drying of the sawdust bath, but to the fact that the electrolyte was not properly cleansed from the strip. The swill boxes failed to act efficiently.

MR. SHERARD COWPER-COLES, managing director of the Cowper-Coles Co., electro-metallurgists, said that he was the first man to introduce electro-galvanising commercially about 25 years ago. He examined the plant in question at Bradford. The dynamo was too small, and the galvanising tank was wrong from a mechanical point of view. The plant was also faulty from an electrical point of view. The anodes were not in the proper position. The passing of the strip in and out of the tank caused lamination. There was also belt slip, which gave a jerky action and increased the liability of the strip to snap. For good working it was necessary to have a very long tank and a straight run. It was not possible to get satisfactory results unless the strip ran horizontally through the electro-galvanising plant. So far as general design was concerned, he did not think the Bradford machine could ever be got to work satisfactorily.

Cross-examined by MR. TERRELL, WITNESS said there were only two makers of flexible tubing in England who galvanised their own strip.

WITNESS would not admit that a certain amount of sodium chloride or potassium chloride in the electrolyte would improve its efficiency. It was impossible to cleanse the electrolyte off the strip by means of the cold water jets fitted on the plant in question. The strip should be passed through a tank of boiling water.

MR. COWPER-COLES was still under cross-examination when counsel conferred, and MR. WAUGH asked the Referee to adjourn. A suggestion had been made which would be submitted to his clients.

The LEARNED REFEREE consented to an adjournment, and on Friday morning (June 30th), when the case was called, MR. WAUGH said that the parties had agreed to terms which were endorsed on the briefs, and would not be mentioned publicly. He asked his Honour to make an order in accordance with those terms.

MR. MUIR MACKENZIE made an order as desired.

THE NATIONAL TELEPHONE TRANSFER.

ON Monday, July 3rd, before the Railway and Canal Commissioners, Mr. Justice A. T. Lawrence, the Hon. A. E. Gaythorne Hardy, and Sir James Woodhouse, had before them again the matter of the National Telephone Co., Ltd., *v.* The Postmaster-General, upon an arbitration in respect of disputes arising out of the agreement for the transfer of the applicants' undertaking to the Postmaster-General. Sir A. Cripps, K.C., Mr. Danckwerts, K.C., Mr. Forbes Lankester, K.C., and Mr. Morten, K.C., led for the applicants; and the Attorney-General (Sir R. Isaacs, K.C.), and the Solicitor-General (Sir J. Simon, K.C.), led for the Postmaster-General.

SIR A. CRIPPS said they now came to deal with the question on its merits. He had very carefully considered how they could best deal with it so as to minimise the trouble of an inquiry of this kind, and bring it, if possible, within reasonable limits. He thought he ought to call their engineer, Mr. Gill, in order to explain matters of fact, which it was necessary should be explained before they came to close quarters with some of the difficulties involved in the case. Before that was done, he would refer to the judgments given in the Court of Appeal. He then read the judgment of the Master of the Rolls and the other judges, and said that after the last hearing they wrote to the Postmaster-General asking him to give them some information on the question of duplication. The Postmaster-General replied on June 30th that the plant, lands, and buildings to which he objected on the ground that the same were not actually required for the Post Office telephone service, were described in Part 1 of the schedule to the notice relating to London, dated August 29th, 1910, and in the ninth paragraph of Part 2. Part 1 related to London, and in substance dealt with a number of exchanges and plant, wires and cables in connection with them, which, in the view of the Postmaster-General, ought to be excepted from the arbitration on the ground that they were not wanted. On Part 2 the Postmaster-General said there was only a portion of the plant he objected to, and the Postmaster-General had given four illustrations in his memorandum.

The ATTORNEY-GENERAL said the illustrations were not intended to be exhaustive. They referred to London, Brighton, Newcastle and Newport.

SIR A. CRIPPS said he understood the nature of the objection to be this: There was a change from the overhead to the underground system, as regarded the particular places indicated. When that was done there might still be the distributing wires overhead, and a distributing wire under the agreement was defined as a wire not more than a quarter of a mile in length. If it were more it ceased technically to be a distributing wire. What was suggested by the Postmaster-General, was that in changing from an overhead to an underground system, too much wire had been left, in certain cases, overhead, and some of it was not being used. He agreed they could not ask the Postmaster-General to take that which was not being used, but in these cases it would be a question of fact for the Court to decide. If the Court determined the point, say in regard to Tottenham and Wood Green, probably the engineers on both sides would work out the decision as affecting other places.

The ATTORNEY-GENERAL said the Postmaster-General stated in the letter of June 30th that it must not be understood that in giving these particulars he was confining his grounds of objection to the plant mentioned to the grounds of redundancy.

SIR ALFRED CRIPPS said he would first go into evidence so far as London was concerned. Probably the evidence as to London would cover other areas outside London. He intended to call engineers to show that the plant in London was suitable for the Post Office service.

Evidence was then called, when MR. FRANK GILL, engineer-in-chief to the National Telephone Co. since 1902, said he had had 26 years' experience of telephones, and had dealt with estimates totalling an expenditure of over £5,000,000. During the time he had been engineer-in-chief the company had added 300,000 stations to the system and 542 new exchanges. The work had been carried out under his supervision. In addition, many exchanges had been reconstructed and many lines placed underground, with the result that a large proportion of the company's plant and the connection of the services with the exchanges were on the most approved modern style. Particularly was this so in the case of the larger exchanges. About 68 per cent. of the total mileage of lines and cables were now underground.

SIR A. CRIPPS: Did you find any difficulty in applying these notices to the particular portions of your service?—Yes, no two competent engineers would arrive at the same conclusion on the matter.

His LORDSHIP: You mean the reading of the notices would be so very wide?—Yes.

WITNESS said there were 93 exchanges altogether belonging to the Post Office and the National Telephone Co. in the London area. Sixty-two of these belonged to the company and 31 to the Post Office. On December 31st, 1910, there were 118,596 exchange lines in the London area altogether. Of this number, 70,700, or nearly 60 per cent., belonged to the company and 47,896 or, roughly, 40 per cent., to the Post Office. The total number of exchange stations was 194,003, and of these 122,680 or about 63 per cent. belonged to the company and 71,323 to the Post Office. In substance the company's system comprised about two-thirds of the whole telephone system of London. In regard to the Avenue exchange, in witness's opinion, a considerable portion of the plant there ought to be maintained and utilised whatever the Postmaster-General's intentions might be. In the case of some of the notices it would be impossible to apply them for physical reasons, and, in other cases, they would amount to a ridiculous destruction of plant. In his opinion, the company had in substance no superfluous plant at all. Cables used for connecting condemned exchanges could not be done away with without interfering with other lines of communication passing through and beyond the area of those exchanges. In many cases within the London area separation between condemned lines and useful lines would be impossible. Into the Gerrard Exchange, for instance, to which he understood no objection had been taken, 33 cables entered, each carrying 600 pairs of wires, or in the aggregate 19,800 pairs. In 13 of these cables there were 496 lines connecting Gerrard with exchanges which had been objected to. These cables, however, were not separable because none of them contained only condemned wires. Most of the company's cables, too, contained spare wires. These wires were not more than was necessary, and were not separable from the other wires in the cables.

MR. JUSTICE LAWRENCE suggested that some method might be arrived at of avoiding the necessity for entering into so much detail. The Government, he said, thought they could not make their objections more plain in their notices, and, as things were, he did not see how the Court could get at the facts.

SIR JAS. WOODHOUSE said it appeared to him that what was really wanted was some scheme whereby the Post Office could show how the things they proposed to object to must come within the terms of the deed. That would save much necessity for going into detail.

The SOLICITOR-GENERAL: The agreement is an agreement by which we buy what we want, and we indicated what we wanted by the process of exclusion. It is not for us, but for them to explain their position.

SIR A. CRIPPS said his evidence was that not only on the question of "suitability," but on the question of "need" under Clause 3, there was the question to be considered of an inseparable piece of plant. If the plant was suitable at all, in however small a degree, or if it were wanted at all, then, according to the view of the company, and, as he believed of the Court of Appeal, if he appreciated its decision rightly, such plant could not be ruled out from the case under arbitration. When they came to determine prices, the degree of suitability and the degree of need might be important matters to consider. But what he had shown was that all these lines had, of necessity, elements of suitability, and could not be ruled out at this stage.

The SOLICITOR-GENERAL said he could hardly regard, as a way to the business solution, the proposal of the company that the Post Office should take over the whole of the company's undertaking, lock, stock and barrel.

MR. GILL was then examined as to the efficiency of the equipment of the company and its suitability for the service of the Post Office. He stated that the company had 880 instruments of the central battery type connected with the 21 London exchanges objected to by the Post Office. There were also 6,852 convertible instruments,

which, by quite a minor alteration, could be made practically central-battery instruments. In addition, there were 13,266 instruments of the local battery type. All these could be made, at a very small expenditure, available for use on a central-battery system. The local instrument when used in connection with a central-battery exchange, would still receive its energy for speech from the battery in the subscriber's office, but the method of communication would be greatly simplified so that the mere removal of the telephone from the hook would call the exchange, instead of having to ring. Answering other questions, Witness gave the result of certain calculations made by him, which showed, he said, that the central-battery system of the company was more economical than the magneto system of the Post Office. That central-battery system, he said, was very suitable for the use of the Post Office, and he, in fact, understood that the Post Office intended to adopt the central-battery system in some of its exchanges. Speaking as an engineer, Witness said any attempt to replace the 21 London exchanges objected to by December 31st would be likely to work an injury to the public service. Such a change, said the Witness, could not be effected in a short time, and ought not to be tried. In Witness's view, substantially all the plant covered by Part 1 of the notice was suitable for the working of the combined system.

Questioned with regard to the Postmaster-General's rejection of iron wire circuits, WITNESS said that in the few instances where iron wires did exist, they were suitable for the work. For instance, in one case, a very windy place, the ordinary copper wire was not stout enough, and with the consent of the Post Office itself, the company put up an iron wire there, and it was doing its work well. In such a case as that he was prepared to argue that iron wire was suitable.

His LORDSHIP: I thought the objection to the iron wires was that they failed in conductivity?—WITNESS: That is not so, my lord. The specific conductivity of iron wire is lower than that of copper wire, and if you want to get a certain degree of transmission, you must put heavier iron wire than would be the case with copper wire. So long as it is heavier, there is nothing the matter with it. There are only 86 miles of iron wire circuit belonging to the company, and of these 29 miles were especially arranged with the Post Office. Witness thought all the company's overhead wires would be suitable for the combined system.

SIR A. CRIPPS: As regarded the notice concerning any portion of your telephone line laid on or across or along a railway driven by electric power, have you ever had any danger or difficulty arising from the two systems coming into contact?—WITNESS: We have had one case where trouble arose, and that was in connection with the Bank Exchange and the District Railway in 1905, I think. At that time the District Railway was not an electric railway at all, but it was in the course of being converted, and ordinary precautions were not taken in connection with such work. By arrangement with the Telephone Co., the contractors who were converting the line were altering the position of our cables near the line. The railway line was not supposed to be alive, and the railway people had had instructions not to turn the current on until they had advised the company. Through some misunderstanding, however, the current was turned on. It so happened that one of the railway men had left a piece of steel troughing against the live rail. Without any examination to see if the rail was clear, the current was turned on and short-circuiting resulted, causing the trouble of fire. I do not know of any other case.

SIR A. CRIPPS: Are all your cables laid in the proximity of electric railways suitable for their work?—Yes; and they are safe.

Cross-examined by SIR J. SIMON, WITNESS said he did not know whether, if the Post Office succeeded in their objection in Part I of the notice, they would have no magneto system of telephones at all. He admitted that in a place like London the central-battery system was superior to the magneto system. If he were planning a new system he would have a central-battery system. It was probable that had the company's business not been coming to an end shortly they would have gone much further in substituting the central-battery system for the magneto system.

(*To be continued.*)

SELLON AND ASHBY AND THE HARTLEPOOL ELECTRIC TRAMWAY CO., LTD., *v.* THE HARTLEPOOL CORPORATION.

IN the King's Bench Division Mr. Justice Bray delivered his reserved judgment in this action to recover £12,963, the purchase price of the Hartlepool tramways. The Corporation were doubtful as to which of the plaintiffs were entitled to receive the money.

His LORDSHIP reviewed the proceedings taken under the arbitration and in relation to the special case, when he suggested that an action should be brought to see whether the plaintiffs were entitled to enforce the payment of the agreed sum of £12,963. It was contended at the hearing that the purchase price of the undertaking was payable to the plaintiffs, Sellon and Ashby, on the transfer of the undertaking to the Corporation, and that the company were willing to join in any conveyance to the Corporation. The contention of the Corporation was that they were not bound to pay any part of the £12,963, and that the property was not the property of the promoters within the meaning of Sec. 43 of the Tramway Act. The main question was what was the real construction of Sec. 43, and what was the true position of the promoters. It was clear that the plaintiffs, Sellon and Ashby, were the owners of the undertaking. They, and they alone, could be required to sell to the Corporation. The main point argued was that the tramways and other things mentioned in the particulars of claim did not belong to the promoters, and were not used by them within the meaning of Sec. 43. He (the learned Judge) was of opinion that they were so used. The tramways never became the property of the company, and they must have belonged to some one. He saw no difficulty in coming to the conclusion that they belonged to the promoters. He thought that was the legal result of what had passed, and in no other way could the Corporation obtain the tramways as they had a right to do under Sec. 43. The form of judgment would be a declaration that the Corporation were entitled to, and bound to purchase the undertaking upon payment of £12,963 to the promoters, and the plaintiffs must undertake to execute an assignment or transfer, and if the Corporation required it, the plaintiff company must join in the conveyance.

Costs would follow the event.

SPECIAL TRAMWAY FARE.

LORD SKERRINGTON has given judgment in the Court of Session in the action at the instance of the Edinburgh and District Tramways Co., Ltd., against Hope Park, S.S.C., 22, Claremont Crescent, Edinburgh. The defender boarded a special car on the day of the Rugby International at Inverleith, but declined to pay the special fare of 2d., and tendered 1d., the ordinary fare. The pursuers contended that they were entitled to provide additional special cars, and to demand for these fares in excess of the fares ordinarily charged but within the authorised limits. They sought declarator of that right and sued for 1d. The defender explained that he tendered the 1d. sued for, but that that offer was refused and the 1d. returned to him. Later he again tendered the sum sued for with judicial expenses. The pursuers refused to accept the tender and persisted in the present proceedings. His Lordship dismissed the action and found the defender liable in expenses, and on the motion of the pursuers' counsel found it unnecessary to dispose of the conclusion for declarator.

BUSINESS NOTES.

Tantalum Competition.—As our readers will observe in our advertising pages to-day, MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Tyssen Street, Dalston, N.E., are offering a couple of prizes in connection with their autumn publicity campaign. The prizes are of sufficient value to encourage a wide competition among those gifted in the preparation of showcard designs. The first prize amounts to £75, and the second to £25, and as the competition is open to anybody in the United Kingdom, and a large number of designs are sure to be submitted, it has been decided that for designs of more than average merit which may also be accepted, a solatium of £5 will be awarded. Of course, what is wanted is a design which will irresistibly take possession of the public mind, make a permanent impression, "fix" the tantalum lamp and its merits for satisfying consumers, without haunting one as some posters have a weakness for doing. The electrical man who is a designer, knows the argument that he wants to get home, and he knows to some extent from experience what is the point at at which the public are most vulnerable, but in opening the competition to everybody, whether electrically minded or no, Messrs. Siemens recognise that not all the ability of appealing to the public lies inside the electrical world, and it may be that the more or less uninitiated electrically, may bring into play ideas which shall, when put on a showcard, be a creditable effective sales-promoting advertisement which would put to shame many of the "things" that one sees on hoardings, and would be well worthy of a place beside—well, what? We need not enter into particulars here concerning the sizes of designs to be submitted, and the general conditions to be observed, for these are fully stated elsewhere, but it may be noted that political subjects are barred, and that it may be desirable to introduce in some way or other the features of the well-known "satisfied consumer" design which has done such good service. Printed leaflets giving full details have been issued to contractors, &c., in order that their customers may be fully notified of the competition, and copies of these can be obtained by anybody who has not received them. The competition is open until July 31st, and designs have to be sent to the firm at Tyssen Street, together with a copy of the advertisement conditions. We hope, after the result is declared, to publish the names of the prize winners in the columns of the ELECTRICAL REVIEW.

Bankruptcy Proceedings. — GEORGE MONTAGUE SELLICK, manufacturer of electrical accessories, 464, Romford Road, Forest Gate.—An application for an order of discharge was made on June 27th to Mr. Registrar Brougham, at the London Bankruptcy Court. Mr. Egerton S. Grey, Official Receiver, reported that the bankrupt failed in January, 1907, with proved and provable debts to the amount of £473. The assets had realised £102, and a first and final dividend of 3s. in the £ had been paid to the creditors. Having been previously employed as clerk to a firm of electrical engineers, the bankrupt in June, 1895, without capital, started business on his own account as a manufacturer of electrical accessories at 68, Glen Park Road, Forest Gate. In 1897 he removed to 50, Park Lane, Tottenham; in the following year to 756, Romford Road, and in 1903 to 464, Romford Road, at which latter address he was trading at the date of the receiving order. Down to 1904 the business was fairly successful, but thereafter, owing to foreign competition, it fell off; in June, 1906, his difficulties were further increased owing to the expense of his wife's illness: and realising the hopelessness of his position, the bankrupt

filed his petition on January 31st, 1907. Since the receiving order he had been in employment as manager of an electrical manufacturing business, and was in receipt of a salary of £2 6s. per week. As offences, the Official Receiver reported (1) insufficiency of assets to equal 10s. in the £ on the amount of the unsecured liabilities; (2) omission to keep proper books of account; and (3) trading with knowledge of insolvency. His Honour upheld the report and imposed a further suspension of two years. Order entered accordingly.

EMANUEL RISTORI.—At the first meeting of creditors held on June 30th it was stated that the liabilities were £100,000, principally in respect of borrowed money. Mrs. Ristori (widow) said that she knew of no assets except a claim against the Aluminium Corporation, Ltd. In the absence of a quorum the meeting was adjourned for a week.

C. F. LINDOP, electrician, lately carrying on business at 62, Dale Street, Liverpool.—Receiving order made June 29th, at Liverpool, on creditor's petition.

T. C. FRANCIS, electrical engineer, 66, Liverpool Road, Stoke-on-Trent.—Receiving order made June 28th on debtor's petition. First meeting, July 12th, at Newcastle, Staffs.; public examination, July 18th, at Stoke-on-Trent.

Liquidation.—MESSRS. MOUNTAIN & GIBSON, LTD.—A meeting is to be held at Parr's Bank Buildings, York Street, Manchester on August 1st, to hear a report of the winding up from the liquidators (Messrs. H. H. Bowden and A. Whittaker).

Direct Supply at Trade Prices.—A firm of electrical and mechanical engineers inform us that they recently asked an agent for a certain make of incandescent lamps to supply a consignment of the latter direct to one of the firm's clients, in order to save time; the agent took the opportunity to quote to the client the same terms and trade discounts as to the contracting firm, and even offered other lamps at lower prices than the contractors themselves could obtain, asking the purchaser in future to buy lamps direct from him. This is a fresh example of a practice which has frequently aroused the indignation of contracting firms, though in this case the makers of the lamps appear to have had no hand in the matter. It is difficult to see what benefit the agent derives from this unfair dealing; he gains nothing in price, while he naturally alienates the contractors, who are not likely to place any more business with him.

Catalogues and Lists.—MESSRS. THOMAS BROADBENT AND SONS, LTD., Central Ironworks, Huddersfield.—Sixteen-page well-illustrated pamphlet containing a description of their automatic centrifugal clutch which is of particular service in connection with A.C. motor drives, large numbers having been supplied for this purpose for textile and similar machinery with satisfactory results.

MESSRS. D. H. BONNELLA & SON, LTD., 58 and 60, Mortimer Street, London, W.—Eight-page pamphlet, Sec. L (No. 354) showing, and stating prices of, a number of their switches, wall sockets, pushes, plain and ornamental switch fronts.

THE INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD., Silvertown, E.—A set of lists of the company's electrical manufactures, in binding cover, arranged to facilitate substitution or addition of new publications as issued. The contents at present are as follows:—Sixteen-page price list of gutta-percha, india-rubber, silk and cotton-covered wires, jointing tools and materials; 16 pages devoted to prices of galvanic batteries; a four-page price list of electrical bells, pushes, &c.; a fine 62-page booklet containing a large number of illustrations, with prices all boldly indicated and brief matter conveniently arranged, of Silvertown telegraph and other instruments; descriptive circulars relating to the Rymer-Jones standard mica-tinfoil condenser, and the Rymer-Jones universal shunt; a 24-page price list of insulators, fittings, and tools for telegraph and telephone lines; an excellently produced brochure containing specification description of Silvertown dynamos and motors, voltages, B.H.P., speeds, code-words, and prices being plainly tabulated; and, last of all, a 24-page publication relating to Association electric light cables and wires. We have no doubt that this fine collection of literature concerning Silvertown manufactures, much of it admirably illustrated on art paper, and containing a great deal of price information, will prove of service to a large number of the firm's present and prospective clients at home and abroad.

THE UNDERFEED STOKER CO., LTD., Coventry House, South Place, Finsbury, E.C.—28-page pamphlet containing a full description, accompanied by various half-tone illustrations and line drawings, of their "Usco" air heater.

MESSRS. TETLEY & CO., Falcon Electrical Works, Salford.—Advanced leaflet showing their "New Departure" (15-ampere and 10-ampere) double-pole switch fuse, a feature of which is the complete removal of the switch fuse carrier for the replacement of the fuse. It is specially designed for controlling small motors, public street arcs, &c.

MESSRS. ARCHIBALD J. WRIGHT, LTD., 41, Beech Street, Barbican, London, E.C.—New illustrated price list (8 pages) of electric head, side, tail and roof lamps, garage or inspection lamps, switches, ignition accumulators, charging boards, dynamos and batteries, ignition coils, measuring instruments, and other accessories for motor-cars and cycles.

THE GLOBE ELECTRIC CO., LTD., 11, Farringdon Avenue, London, E.C.—Price list (No. S50) fully describing the essential features of their "Standard" flame arc lamps—10 hours and 16-18 hours. Tabulated particulars of size, burning hours, current, candle-power, weight, length of carbons and prices, are given.

MESSRS. E. BROOK, LTD., Colne Road, Huddersfield.—Illustrated price list of single-phase motors from 3 to 50 H.P., fitted with slip-rings and ball bearings.

MESSRS. HASLAM & SCHONTHEIL, LTD., 11, Windsor Place, Cardiff.—Leaflet giving prices of cylindrical bellows for blowing out armatures, and of "National" electric compound for commutators.

THE BRITISH ALUMINIUM CO., LTD., 109, Queen Victoria Street, London, E.C.—Illustrated reprint (No. 114) relating to the use of aluminium wire in traction motors.

Trade Announcements.—MESSRS. GENT & CO., LTD., have removed their London office from 3A, Upper Thames Street, to more commodious premises at 25, Victoria Street, London, S.W., where all communications henceforth should be addressed. Telephone, "No. 548 Westminster." Telegrams, "Knifeedge, London."

Owing to increased business, MESSRS. MARSH, SON & CO., LTD., have removed from 15, Gerrard Street, Soho, to more commodious premises at 167 and 169, Wardour Street, Oxford Street, W.

MESSRS. C. H. DAVIES & CO., are removing on July 10th to 153, Bracebridge Street, Birmingham.

THE ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., are now (from July 3rd) represented for their electrical manufactures in and around the city of Sheffield for a radius of 10 miles by Mr. H. E. Ridley, 104, Marlcliffe Road, Sheffield. The agency for their "Vickers" centrifugal fans will remain as before in the hands of Mr. J. Crawford, 2, Exchange Street, Manchester.

MR. E. H. MILNER, electrical engineer, 48, Denmark Street, High Wycombe, has taken larger business premises at Oxford Road.

MR. J. A. ADAN, late of the Ghent electricity works, has commenced practice as consulting electrical engineer at Rue de Flandre, 31, Ghent, Belgium.

Swiss Machinery in India.—With reference to the comments published in this section last week concerning German machinery in India, we are reminded that Swiss electrical manufacturers have lately been successful in this market. For instance, the Maschinenfabrik Oerlikon has in hand a contract for three 3,000-KW. Oerlikon high-pressure steam turbines and three-phase generators; one 800-KW. mixed-pressure turbine and three-phase generator (Oerlikon series-parallel type); complete with condensing plant and air and circulating pumps driven by Oerlikon motors. The same company has also booked a large order for electrical equipments for two cotton mills from Messrs. Forbes, Forbes, Campbell & Co., of Gokak. The order comprises 227 single-phase commutator variable-speed, ring-frame motors; three vertical 900-B.H.P. three-phase generators; two vertical 90-B.H.P. D.C. and three-phase generators (double); and complete main and distribution switchboards, switch columns, switch boxes, main and distribution cable.

LIGHTING and POWER NOTES.

Accrington.—The B. of T. has approved of the draft order sanctioning the supply of electricity in bulk to the Haslingden Corporation, and also the laying of extra H.T. mains to the Baxenden borough boundary.

Barking.—The U.D.C. has asked the L.G.B. to postpone the proposed inquiry into the application for a loan for E.L. extensions, as the Council desires to go further into the matter.

Barrow-in-Furness.—At the monthly meeting of the T.C., the electrical engineer reported that there are now four or five houses at Biggar Bank, Walney Island, and that there is every prospect of a number of additional houses being built, and suggested that as the tramways are now being extended to there, an extension of the electricity mains for lighting and heating purposes be carried out by means of bare overhead wires, supported from the tram poles. The estimated cost of extension, together with pilot wires and distributors to the present houses, is about £407.

The Council approved, and resolved also that subject to a satisfactory settlement being arrived at, application be made to the L.G.B. for its sanction to the Corporation borrowing £5,600 for the supplying of electricity to Ramsden Dock, Barrow.

Bath.—The E.L. Committee of the T.C. has decided to apply to the L.G.B. for a loan of £400 for a booster.

Batley.—The Yorshire Electric Power Co. is proposing to extend its mains from Dewsbury to Gomersal, to supplement an existing main to Pudsey. The Dewsbury and Birstall Councils are offering no opposition, but the Batley Corporation objects to the breaking up of Bradford Road, which is already congested with electrical cables, pipes, sewers, &c. Last week the case was argued before Mr. W. A. Patchell, on behalf of the B. of T., when the company's proposals and recent negotiations with the Corporation were discussed at length.

Belfast.—The city accountant has submitted the accounts of the electrical undertaking for the year ending March 31st, 1911, which were considered highly satisfactory, the net profits, after paying the capital charges, being £13,766, from which the usual appropriations, including £5,000 towards the relief of taxes, were made.

Bradford.—A statement of accounts of the Corporation Electricity Department, just issued, shows, for the year ended March 31st, a surplus of £8,980, as compared with £7,399 in the preceding year, being an increase of £1,581. The income showed an increase of £4,117, the sources of which were £1,853 from general supply, £858 from bulk supply, and £770 from tramways. There had also been an increase in expenditure, amounting to £2,537.

Cardigan.—An E.L. scheme has been submitted to the Council by Mr. Fred. Swarbrick, of Leigh, Lancs., who offers to carry it out, by means of a company, if the Council does not care to take it up. The Council has decided not to promote the scheme, but not to raise any objection to the formation of a company.

Chatham.—In order to better meet the needs of its increasing business, the Kent Electric Power Co. has removed its offices to central premises at the corner of High Street and Railway Street, Chatham, at which address an electrical showroom will shortly be opened. All communications for the company should be sent to Railway Street, Chatham. Telephone, 357 Chatham.

Chester.—Mr. S. E. Britton, city electrical engineer, has prepared and submitted to the Lighting Committee a comprehensive scheme for utilising the River Dee water at the Old Dee Mills for the generation of electrical energy. In the event of expert opinion being favourable to the scheme, the Committee will proceed with it, application being made to the L.G.B. for sanction to borrow the sum of £5,000 towards the cost of executing the works, estimated at £10,000, which it is proposed to meet as follows: Appropriation from uninvested reserve fund, £5,000; and loan, £5,000. In view of this project, it has been decided to postpone the construction of a lock below the weir.

Croydon.—The B.C. has agreed to the following reductions in charges for current:—Flat rate, 4d. to 3½d. per unit; heating and cooking, 1½d. to 1d. for consumers using electric light; 1½d. to 1d. for all current for traction purposes above 2,000,000 units.

Dublin.—The Electric Lighting Committee of the Corporation has received the sanction of the L.G.B. for a loan of £50,000 to carry out an extension of the electricity works. A letter from the Board to the Committee states that it has received the report of its chief engineering inspector, on the inquiry held a short time since into the application for sanction to the borrowing of £128,129 for the carrying out of the extensions of the electric lighting of the city. As some time must necessarily elapse before the Corporation can be addressed at length on the inquiry, the Board thinks it desirable that in the meantime it should be enabled to borrow a portion of the amount of the loan in question, and accordingly sanctions the borrowing of a sum of £50,000, repayment to be made in a period not exceeding 20 years.

Eccles.—Sanction has been received from the L.G.B. to the borrowing of £3,294 for the provision and installation of a 500-K.V.A. steam alternator at the electricity works.

Gloucester.—A L.G.B. inquiry was held on June 27th into the application of the T.C. for a loan of £14,000 for electricity purposes. There was no opposition.

Hastings.—The Education Committee has decided to have the E.L. installed at Clive Vale and Tower Road schools, at an estimated cost of £185 5s.

Heston and Isleworth.—The electrical engineer reports having further interviewed the engineer to the Twickenham Electricity Supply Co., Ltd., respecting a supply of current in the Whitton Park area. As a result of this interview arrangements have been made for payment on a basis which has been approved by the Electricity Committee, and a formal application from the company for a supply of current has been received.

Hornsey.—A L.G.B. inquiry has been held into an application by the B.C. for sanction to borrow £9,600 for extensions to the buildings and plant at the generating station. It was explained by the town clerk that the land on which it was proposed to erect the buildings had been purchased some time ago as a site for baths. It was proposed to put in foundations for an additional boiler and cooling tower. The boiler house would then provide for two additional boilers, that was seven in all, and two additional bunkers, making seven in all. The electrical engineer said that the undertaking up to the present had done exceedingly well, and that the proposed extensions was to meet anticipated increased consumption.

Hoyland Nether (near Barnsley).—At the last meeting of the Lighting Committee of the U.D.C., one of the members expressed his disapproval of the present system of public lighting, and urged the Council to adopt a scheme of electric lighting for the district.

Hull.—The T.C. is considering the question of supplying current for lighting and power to St. Andrew's Dock.

Ilford.—The U.D.C. has fixed the price of current for the tramways at 1½d. per unit.

India.—A licence has been granted by the Municipal Commissioners of Chittagong to the agents of the A.E.G.-Lahmeyer Co. for the supply of electric lighting and power to that town. Chittagong is the headquarters of the Assam Railway, and it is understood that the railway is supporting the scheme. The main streets are to be lighted, and the power will be used for the driving of the punkahs, so much used in that part of India. The preliminary scheme is being drafted by Mr. H. R. Speyer, A.M.I.C.E.

Kingston-on-Thames.—At the last meeting of the T.C., it was agreed that the electrical engineer, together with his chairman and vice-chairman, should visit the works of the M.A.N. Co., Germany, with a view to inspecting Diesel engine plant. It was suggested that similar engines would be shown at the forthcoming Olympia Exhibition, also that English made engines would be equally satisfactory, but in view of the size of engine contemplated, and the type which it is proposed to adopt, involving an expenditure of £8,000 to £10,000, it was agreed to visit the German works as stated.

Llangollen.—In connection with the deadlock existing between the Council and electric light company, the Council has asked the company if it is prepared to apply for a provisional order under the 1903 agreement.

London.—ST. PANCRAS.—At the last meeting of the B.C. the Law Committee reported in regard to an action which had been entered against the National Telephone Co. for the recovery from the company of £180, being the cost of repairing damage done to the Council's electric mains and services, &c., in Upper Woburn Place by the company's workmen, that the company offered to settle the action by payment of the claim, each party bearing its own costs, and this was agreed to.

METROPOLITAN ASYLUMS BOARD.—At the last meeting of the Board it was agreed to provide at Tooting Bec Asylum two electric lifts, capable of carrying 5 cwt., at an estimated cost of £210 per lift. The Committee stated that the hand lifts in the older blocks are so cumbersome that they are rarely worked unless absolutely necessary. With electricity at a 1d. per unit, the 5-cwt. lift would make 18 complete journeys with full load for 1d. The other working costs apart from electricity would be infinitesimal.

Oldham.—The T.C. has reduced the price for current on the flat-rate from 4d. to 3½d. per unit. For power the present rate of £2 10s. per KW. per annum, plus 0·5d. per unit metered, has been altered to £2 10s. per KW., plus 0·4d. per unit metered to consumers of 25 H.P. and over.

New Zealand.—The first step towards harnessing the Waira Falls for the generation of electricity is about to be taken. A survey party is presently engaged in defining the line between Kaikhoe and Horeke, and is to continue the work between the Falls and Whangerie and the Falls and Dargaville. The Government has made a small grant to cover the survey, which is to be completed as rapidly as possible.

Perth.—The Convener of the Corporation Gas Committee has issued a report strongly supporting the proposal to install electric stoking plant at the gas works. Such plant, it is estimated, would effect an annual saving of £1,000.

Salford.—Application is to be made to the L.G.B. for sanction to borrow £3,000 for extending mains and services in the Prestwich District. In accordance with recommendations contained in the report of Sir A. B. W. Kennedy, alterations to the engines at the electricity works are to be proceeded with at an estimated cost of about £20 per engine. Tenders are also to be invited for the supply and fixing of a new boiler.

South Africa.—The Cape Town Corporation has completed an agreement with the Municipality of Woodstock to continue the supply of electrical energy for a further term of seven years from December 31st, 1912, such agreement to remain in force, after the expiration of the period, from year to year. In connection with this agreement the Corporation is extending the area in which it supplies private consumers, and has accepted a tender from the Telegraph Manufacturing Co. (Colonial), Ltd., for the supply of the necessary cable; the amount of the tender is £1,090.

Southborough.—The U.D.C. has received from 29 residents a memorial requesting a supply of electricity for lighting. The Tunbridge Wells T.C. has already arranged to supply current to premises in the town, and the Kent Power Co. is in communication with the Council.

Stirling.—The T.C. has decided to replace all its Nernst lamps by metal-filament lamps, the cost being estimated at £40. An annual saving of £60 is expected.

Stoke-on-Trent.—The T.C., on June 29th, referred back to the Electricity Committee a proposal to wire on the hire-purchase system the premises of the Longton Working Men's Club. A member protested against the proposal, the legality of which he questioned.

Wellingborough.—The *London Gazette* contains notice of the revocation of the 1906 E.L. order.

Wharfedale.—The Wharfedale E.L. and Power Syndicate has notified the Guiseley U.D.C. of its intention to apply for a provisional order for the urban districts of Baildon, Burley, Guiseley, Ilkley, Otley, Yeadon and the rural townships of Esholt, Menston, Middleton and Pool. It is proposed to charge 3d. per unit for lighting, and from 2d. per unit downwards for power.

Willesden.—The L.G.B. has sanctioned the borrowing of £5,000 for mains and £3,000 for services.

Worksop.—The U.D.C. has decided to extend the mains to St. Cuthbert's College, and has applied to the B. of T. for permission to use overhead wires for this supply, and also for the purpose of lighting certain streets.

TRAMWAY and RAILWAY NOTES.

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The tramways manager has been instructed to report to a sub-committee generally as to the car-shed and workshop accommodation, and as to the provision of machinery for the repair of cars. The sub-committee will afterwards report to the Tramways Committee on the question.

Bradford.—A statement of accounts of the Corporation Electricity Department, just issued, shows, for the year ended March 31st, a surplus of £8,980, as compared with £7,399 in the preceding year, being an increase of £1,581. The income showed an increase of £4,117, the sources of which were £1,853 from general supply, £858 from bulk supply, and £770 from tramways. There had also been an increase in expenditure, amounting to £2,537.

Cardigan.—An E.L. scheme has been submitted to the Council by Mr. Fred. Swarbrick, of Leigh, Lancs., who offers to carry it out, by means of a company, if the Council does not care to take it up. The Council has decided not to promote the scheme, but not to raise any objection to the formation of a company.

Chatham.—In order to better meet the needs of its increasing business, the Kent Electric Power Co. has removed its offices to central premises at the corner of High Street and Railway Street, Chatham, at which address an electrical showroom will shortly be opened. All communications for the company should be sent to Railway Street, Chatham. Telephone, 357 Chatham.

Chester.—Mr. S. E. Britton, city electrical engineer, has prepared and submitted to the Lighting Committee a comprehensive scheme for utilising the River Dee water at the Old Dee Mills for the generation of electrical energy. In the event of expert opinion being favourable to the scheme, the Committee will proceed with it, application being made to the L.G.B. for sanction to borrow the sum of £5,000 towards the cost of executing the works, estimated at £10,000, which it is proposed to meet as follows: Appropriation from uninvested reserve fund, £5,000; and loan, £5,000. In view of this project, it has been decided to postpone the construction of a lock below the weir.

Croydon.—The B.C. has agreed to the following reductions in charges for current:—Flat rate, 4d. to 3½d. per unit; heating and cooking, 1½d. to 1d. for consumers using electric light; 1½d. to 1d. for all current for traction purposes above 2,000,000 units.

Dublin.—The Electric Lighting Committee of the Corporation has received the sanction of the L.G.B. for a loan of £50,000 to carry out an extension of the electricity works. A letter from the Board to the Committee states that it has received the report of its chief engineering inspector, on the inquiry held a short time since into the application for sanction to the borrowing of £128,129 for the carrying out of the extensions of the electric lighting of the city. As some time must necessarily elapse before the Corporation can be addressed at length on the inquiry, the Board thinks it desirable that in the meantime it should be enabled to borrow a portion of the amount of the loan in question, and accordingly sanctions the borrowing of a sum of £50,000, repayment to be made in a period not exceeding 20 years.

Eccles.—Sanction has been received from the L.G.B. to the borrowing of £3,294 for the provision and installation of a 500-K.V.A. steam alternator at the electricity works.

Gloucester.—A L.G.B. inquiry was held on June 27th into the application of the T.C. for a loan of £14,000 for electricity purposes. There was no opposition.

Hastings.—The Education Committee has decided to have the E.L. installed at Clive Vale and Tower Road schools, at an estimated cost of £185 5s.

Heston and Isleworth.—The electrical engineer reports having further interviewed the engineer to the Twickenham Electricity Supply Co., Ltd., respecting a supply of current in the Whitton Park area. As a result of this interview arrangements have been made for payment on a basis which has been approved by the Electricity Committee, and a formal application from the company for a supply of current has been received.

Hornsey.—A L.G.B. inquiry has been held into an application by the B.C. for sanction to borrow £9,600 for extensions to the buildings and plant at the generating station. It was explained by the town clerk that the land on which it was proposed to erect the buildings had been purchased some time ago as a site for baths. It was proposed to put in foundations for an additional boiler and cooling tower. The boiler house would then provide for two additional boilers, that was seven in all, and two additional bunkers, making seven in all. The electrical engineer said that the undertaking up to the present had done exceedingly well, and that the proposed extensions was to meet anticipated increased consumption.

Hoyland Nether (near Barnsley).—At the last meeting of the Lighting Committee of the U.D.C., one of the members expressed his disapproval of the present system of public lighting, and urged the Council to adopt a scheme of electric lighting for the district.

Hull.—The T.C. is considering the question of supplying current for lighting and power to St. Andrew's Dock.

Ilford.—The U.D.C. has fixed the price of current for the tramways at 1½d. per unit.

India.—A licence has been granted by the Municipal Commissioners of Chittagong to the agents of the A.E.G.-Lahmeyer Co. for the supply of electric lighting and power to that town. Chittagong is the headquarters of the Assam Railway, and it is understood that the railway is supporting the scheme. The main streets are to be lighted, and the power will be used for the driving of the punkahs, so much used in that part of India. The preliminary scheme is being drafted by Mr. H. R. Speyer, A.M.I.C.E.

Kingston-on-Thames.—At the last meeting of the T.C., it was agreed that the electrical engineer, together with his chairman and vice-chairman, should visit the works of the M.A.N. Co., Germany, with a view to inspecting Diesel engine plant. It was suggested that similar engines would be shown at the forthcoming Olympia Exhibition, also that English made engines would be equally satisfactory, but in view of the size of engine contemplated, and the type which it is proposed to adopt, involving an expenditure of £8,000 to £10,000, it was agreed to visit the German works as stated.

Llangollen.—In connection with the deadlock existing between the Council and electric light company, the Council has asked the company if it is prepared to apply for a provisional order under the 1903 agreement.

London.—ST. PANCRAS.—At the last meeting of the B.C. the Law Committee reported in regard to an action which had been entered against the National Telephone Co. for the recovery from the company of £180, being the cost of repairing damage done to the Council's electric mains and services, &c., in Upper Woburn Place by the company's workmen, that the company offered to settle the action by payment of the claim, each party bearing its own costs, and this was agreed to.

METROPOLITAN ASYLUMS BOARD.—At the last meeting of the Board it was agreed to provide at Tooting Bec Asylum two electric lifts, capable of carrying 5 cwt., at an estimated cost of £210 per lift. The Committee stated that the hand lifts in the older blocks are so cumbersome that they are rarely worked unless absolutely necessary. With electricity at a 1d. per unit, the 5-cwt. lift would make 18 complete journeys with full load for 1d. The other working costs apart from electricity would be infinitesimal.

Oldham.—The T.C. has reduced the price for current on the flat-rate from 4d. to 3½d. per unit. For power the present rate of £2 10s. per KW. per annum, plus 0·5d. per unit metered, has been altered to £2 10s. per KW., plus 0·4d. per unit metered to consumers of 25 H.P. and over.

New Zealand.—The first step towards harnessing the Waira Falls for the generation of electricity is about to be taken. A survey party is presently engaged in defining the line between Kaikhoe and Horeke, and is to continue the work between the Falls and Whangerie and the Falls and Dargaville. The Government has made a small grant to cover the survey, which is to be completed as rapidly as possible.

Perth.—The Convener of the Corporation Gas Committee has issued a report strongly supporting the proposal to install electric stoking plant at the gas works. Such plant, it is estimated, would effect an annual saving of £1,000.

Salford.—Application is to be made to the L.G.B. for sanction to borrow £3,000 for extending mains and services in the Prestwich District. In accordance with recommendations contained in the report of Sir A. B. W. Kennedy, alterations to the engines at the electricity works are to be proceeded with at an estimated cost of about £20 per engine. Tenders are also to be invited for the supply and fixing of a new boiler.

South Africa.—The Cape Town Corporation has completed an agreement with the Municipality of Woodstock to continue the supply of electrical energy for a further term of seven years from December 31st, 1912, such agreement to remain in force, after the expiration of the period, from year to year. In connection with this agreement the Corporation is extending the area in which it supplies private consumers, and has accepted a tender from the Telegraph Manufacturing Co. (Colonial), Ltd., for the supply of the necessary cable; the amount of the tender is £1,090.

Southborough.—The U.D.C. has received from 29 residents a memorial requesting a supply of electricity for lighting. The Tunbridge Wells T.C. has already arranged to supply current to premises in the town, and the Kent Power Co. is in communication with the Council.

Stirling.—The T.C. has decided to replace all its Nernst lamps by metal-filament lamps, the cost being estimated at £40. An annual saving of £60 is expected.

Stoke-on-Trent.—The T.C., on June 29th, referred back to the Electricity Committee a proposal to wire on the hire-purchase system the premises of the Longton Working Men's Club. A member protested against the proposal, the legality of which he questioned.

Wellingborough.—The *London Gazette* contains notice of the revocation of the 1906 E.L. order.

Wharfedale.—The Wharfedale E.L. and Power Syndicate has notified the Guiseley U.D.C. of its intention to apply for a provisional order for the urban districts of Baildon, Burley, Guiseley, Ilkley, Otley, Yeadon and the rural townships of Esholt, Menston, Middleton and Pool. It is proposed to charge 3d. per unit for lighting, and from 2d. per unit downwards for power.

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The manager's traffic return for the five weeks ended June 17th showed that the passenger receipts for that period amounted to £3,726, compared with £3,440 in the corresponding period of last year, an increase of £286. Each of the five sections produced increased receipts. Up to June 17th the income from the tramways during the current financial year totalled £8,353, and the expenditure £7,851, as against £7,825 and £7,825 respectively last year.

South Lancashire.—Dissatisfaction prevails in the Farnworth, Walkden, Swinton and Worsley districts at the alleged inadequate service on the South Lancashire Tramway Co.'s system, and it is expected that concerted action will be taken by the local authorities to obtain a better service. For several hours during the day there is only a 20 minutes' service.

Stirling.—Representatives of the Town and County Councils and the Stirling and Bridge of Allan Tramways Co. recently considered representations made by the Tramways Co. asking to be relieved of part of its financial responsibilities. It was agreed that so far as the company's share of the maintenance of the roads was concerned, nothing could be done, but it was the feeling of the meeting that something might be done on some of the other points raised by the company.

Sunderland.—The annual report of the Corporation tramways undertaking for the year ended March 31st, 1911, has just been issued by the general manager, Mr. A. R. Dayson. The income during the year was £59,071 and the working expenses £37,188, leaving £21,882 to be carried to the net revenue account. The traffic expenses totalled £17,410, or 2·878d. per car-mile, a slight increase on the previous year. General expenses totalled £5,330, or ·880d. per car-mile; energy cost (at 1½d. per B.T.U.) £10,678, or 1·765d. per car-mile. There is a net balance of £4,344, an increase of £756 on the previous year. The reserve and renewals account now amounts to £29,694, being this year increased by £1,422, while £2,000 is paid towards the Borough Fund.

Uruguay.—H.M. Vice-Consul at Monte Video reports that a local engineering firm, representing a syndicate of French capitalists, has been authorised by the Ministry of Public Works to make surveys for an electric railway from Monte Video along the coast to Maldonado and Punta del Este, a distance of some 75 miles. The power is to be generated by means of low grade brown coal or peat, of which there are large deposits in the neighbourhood of Maldonado. The line is to be double, with overhead cables, and of gauge 1·676 metres. Plans are to be presented within three months from the middle of May. The principal object of the line is the development of the port of Maldonado, and the line will further bring into use large sections of fertile land in the neighbourhood of the coast.—*Board of Trade Journal.*

U.S.A.—The New York City authorities have ordered the construction of a new subway line, which it is expected will be worked by the Brooklyn Rapid Transit Co.

Wigan.—The engineer and manager of the tramways department, in his report to the Tramway Committee, stated that a substantial reduction had been made in the traction energy consumption, which, in his opinion, was attributable to the installation of meters on all the cars. For the last few weeks the consumption per car-mile showed a decrease of ·07 of a unit, and on the first nine weeks of the current year this represented a saving in energy alone of approximately £150.

York.—The Tramways Committee is recommending the City Council to adopt a scheme for extending the tramway system from near the railway station by Bishopthorpe Road to the South Bank area, a populous district at the back of the racecourse, at an estimated cost of £17,000.

The Committee also submits four alternative routes to the Heworth district, one to cost £39,088, another £25,263, a third £56,021, and the fourth £67,144.

TELEGRAPH and TELEPHONE NOTES.

Chicago Telephones.—The possibilities of telephone development are well illustrated by a note in the *Electrical World*, stating that the Chicago Telephone Co. has passed the quarter-million mark in the number of telephones in service in the city of Chicago. This is about one telephone for every nine inhabitants. Chicago has more telephones than any other city in the world except New York, and more in proportion to population than New York. It has twice as many as London, and five times as many as Paris. If London had one telephone for every nine inhabitants, its total would be about 750,000 telephones, or five times the number at present in use.

Federated Malay States.—There are 63 telegraph offices and 12 telephone exchanges in the F.M.S., with 650 telephone subscribers; 5,135 miles of wire are in use, of which 3,117 are telephone lines.

Iceland.—A private company on the Vestmann Islands, on the south-west of Iceland, has obtained a concession to lay a submarine telegraph cable between these islands and Iceland.

Japan.—The Japanese Department of Communications has decided to erect a direct telephone line between Kobe and Arima *viâ* Rokkosan.

Wireless Telegraphy.—SCANDINAVIA.—The telegraph department has ordered three large radio-telegraph stations from the Gesellschaft für Drahtlose Telegraphie, Berlin, to be established on the island of Spitzbergen, at Hammerfest and at Bergen. They are all to be built according to the latest Telefunken system with "singing sparks" for 1,000 cycles per second, and 5 KW. in the antenna. The station at Spitzbergen will further be so designed that if required it can take 6·5 KW. in the antenna. The stations at Spitzbergen and Hammerfest will be furnished with complete charging plant and accumulators, while the Bergen station will be supplied with energy from the local electricity works. The Spitzbergen station will further be furnished with complete spare plant. The range of these stations under ordinary circumstances will be about 1,000 km. in the day time, but at night it will probably be considerably greater.

The Nordenfjeldske Steam Ship Co. has ordered two new ship installations from the A.E.G. for its tourist steamers.

In Sweden (Karlskrona), and Denmark (Copenhagen), the Telefunken Co. have furnished similar 5-KW. stations, and a 10-KW station has been established at Gothenburg.

The wireless stations at Lofoten—the big fishing centre on the North-West Coast of Norway—have proved to be of great importance to the fishing. At Sorvaagen, for instance, the wireless messages received between March 20th and 31st this year made an average of 35 telegrams of 14-16 words each a day.—*Elekt. Tidskrift.*

UNITED STATES.—According to a Bill passed by Congress, after July 1st ocean-going vessels carrying more than 50 passengers will be liable to a fine of £1,000 unless they are equipped with wireless-telegraph apparatus capable of transmitting messages not less than 100 miles, and manned by an operator carrying a certificate issued by this or another Government.—*Electrical World.*

The Baltimore Bridge Co. has received the contract for the three large towers for the wireless system to be used by the Navy Department, near Washington, D.C. The plans of the Navy Department include the erection of towers at Ft. Myer, Va., on the opposite side of the Potomac from Washington, with a main tower 600 ft. in height, and two others of 450 ft. About 900 tons of steel will be required for building these towers. When completed the wireless system is to be capable of sending messages between 2,000 miles and 3,000 miles, and by relays to cover the North Altantic, so that it will be possible to communicate with vessels on the coast of Europe and Africa. The instruments to be used in this system have been building and under trial at Brant Rock, Mass., for over two years, final decision to erect the system being withheld until satisfactory performance of these instruments was made. The Baltimore Bridge Co. submitted alternative bids for the towers as follows:—For one 600-ft. steel tower, $105,541; for two 450-ft. towers, $63,440; for two of the foregoing with complete auxiliaries, $122,954; one 600-ft. tower built on different specifications from the foregoing, $42,101; two 600-ft. towers $82,368.—*Electrical World.*

CONTRACTS OPEN and CLOSED.

OPEN.

Algeria.—July 16th. The Municipal Authorities of Perregaux are inviting tenders for the concession for the electric lighting of the town during a period of 30 years.

Australia.—July 19th. Insulators, telephones, copper wire and iron wire, for the P.M.G.'s Department in Queensland. See "Official Notices" June 2nd.

MELBOURNE.—July 18th and 21st. (*a*) 4 tons 6 cwt. of bare hard-drawn copper cables, and (*b*) 35,700 incandescent lamps, for the City Council. See "Official Notices" June 30th.

August 15th.—80,000 insulators, and india-rubber-covered wire, for the P.M.G.'s Department. See "Official Notices" June 30th.

SOUTH AUSTRALIA.—August 9th. (*a*) Letter box fronts; (*b*) four petrol motor cars, for the P.M.G.'s Department. See "Official Notices" June 30th.

NEW SOUTH WALES.—August 9th. P.M.G. Letter-box fronts. See "Official Notices" to-day.

QUEENSLAND.—August 23rd. Letter box fronts, for the P.M.G.'s Department. See "Official Notices" June 30th.

August 16th.—Cable, conduits, cast-iron pipes, iron poles, insulators, wire, &c., for the P.M.G.'s Department. See "Official Notices" to-day.

TASMANIA.—July 31st. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" to-day.

VICTORIA.—August 8th. Measuring instruments, telephone instruments and parts, and 25 trembling bells, 8-in. gong, for the P.M.G.'s Department. See "Official Notices" to-day.

Belfast.—July 17th. Circulating water and motor-driven air pumps, for the Corporation Tramways and Electricity Committee. See "Official Notices" June 30th.

(*Continued on page 23.*)

ELECTRICAL POWER DISTRIBUTION ON THE NORTH-EAST COAST.

The New Generating Station at Dunston-on-Tyne.

The North-East Coast power system now covers an area of over 1,000 sq. miles, extending from Blyth in the north, to Guisborough in the south, and westward from the coast to Consett and Bankfoot. At the present time it is supplying some 150,000 H.P. of plant in connection with railways, tramways, collieries, shipyards, lighting, heating, cooking, and chemical works. Its principal generating station is at Carville-on-Tyne, which is coal-fired, while it obtains a large quantity of power from stations utilising waste heat from coke ovens, blowing engines, &c. The principal of these are at Blaydon, Newport, Weardale, Bankfoot and Bowden Close. Others are in progress at Redcar, Port Clarence and elsewhere. The steady growth in the company's business has entailed the erection of an additional coal-fired station, which has recently been built at Dunston-on-Tyne, and is here described.

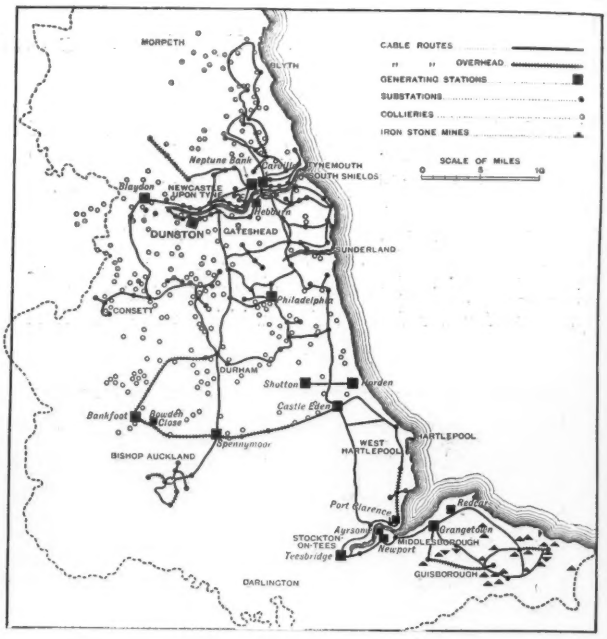
Interior of Engine Room, Dunston Power Station.

The Dunston power station of the Newcastle-upon-Tyne Electric Supply Co.—one of the largest and most recently designed power stations in Europe—contains several novel features. Its construction was decided upon by the company about three years ago in order to provide for the continued increase in business, amounting to about 20,000 H.P. per annum. Although the company has still some spare land at Carville, it was considered by the engineers to be better to put the next instalment of generating plant higher up the Tyne. A site of about 30½ acres was obtained on the south bank of the Tyne at Dunston, about three miles above the High Level Bridge, and by the river some eight miles from Carville. One reason for this course was in order to obtain in the neighbourhood of the station plenty of land for the accommodation of further new processes which are being attracted to the district, as a result of the low price of electrical power. The company is already supplying large electro-chemical works near Carville, but the land available for future developments near Carville is not large, whereas at Dunston there is, at present, plenty of land available for future requirements, besides the spare land on the company's site. Another reason for this policy, apart from the desirability of having two stations for the sake of greater security of supply, railway access, coal supplies, &c., is that it has resulted in practically doubling the carrying capacity of the very heavy cable network which exists on both sides of the Tyne, for, as the map shows (p. 20), Dunston station is situated near one end of the Tyne network, whereas Carville is situated towards the other end. The cables which run on each side of the Tyne are connected together at Car-

ville by means of the tunnel constructed by the company under the river, and higher up the river by way of the two bridges of the North-Eastern Railway, the King Edward Bridge, and the old High Level bridge. It will, therefore, be seen that the erection of the Dunston station improves the position of the company, not only from the point of view of generating station capacity, but also, to a most important extent, from a distribution point of view. The site is directly opposite the western end of the Elswick works of Messrs. Armstrong, Whitworth & Co., and the frontage to the Tyne is some 900 ft.

As the North-Eastern Railway Co. has bridges over the Tyne both at Blaydon and at Newcastle, the Dunston power station being situated about midway between the two, coal

Exterior of Dunston Power Station.



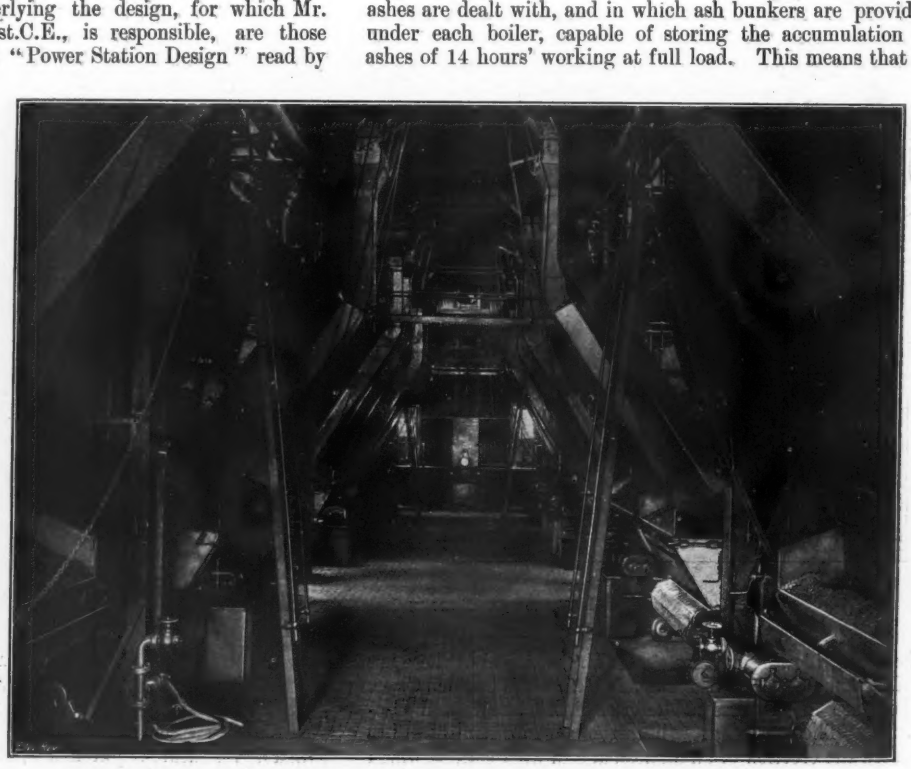
Map of Area Supplied by the Newcastle-upon-Tyne Electric Supply Co.

supplies can be obtained with almost equal facility from either the Durham or the Northumberland coalfields. Condensing water is obtained from the River Tyne by means of suction pipes for each generating unit, taken direct to the river.

The main ideas underlying the design, for which Mr. Charles H. Merz, M.Inst.C.E., is responsible, are those embodied in the paper on "Power Station Design" read by Messrs. Merz and McLellan before the Institution of Electrical Engineers in 1904, and the essential features of the station are apparent from the accompanying drawings and other illustrations. Before describing in detail the plant installed, it may be of interest to call attention to some of the main considerations affecting the design. The station generates three-phase current at a periodicity of 40 cycles and a normal voltage of 5,750 volts. The steam pressure is 200 lb. per square inch, and the steam is superheated, the total temperature being practically 570° F. The station is laid out so as to accommodate eventually six generating units each of 8,000 KW. continuous capacity and 10,000 KW. maximum capacity, or a total capacity of nearly 50,000 KW. If further extensions are necessary, it is intended to commence a new engine room. The engine room has so far been built for four units, of which three are already installed. For every two units there will be one boiler house, or three boiler houses in all, of which one has so far been completed.

On each side of each boiler house there are four boilers—three of which are capable of driving one generating unit at full load—or eight boilers per house, so that eventually there will be 24 boilers in the station.

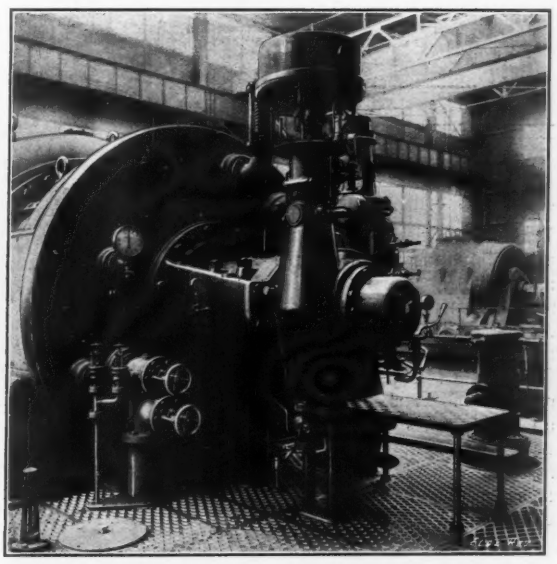
The lowermost portion of the boiler house consists of a very roomy basement some 18 ft. 6 in. high, in which the ashes are dealt with, and in which ash bunkers are provided under each boiler, capable of storing the accumulation of ashes of 14 hours' working at full load. This means that at ordinary load factors each ash bunker need only be cleared once in every 24 hours. The ashes are removed by trucks, which are elevated by electric lifts, and dump the ashes into a large overhead ash bunker for each boiler house. This ash bunker has a capacity equivalent to from two to three days' working of the boiler house, and is arranged over a railway siding, so that ashes may be either taken away by rail



Interior of Boiler House.

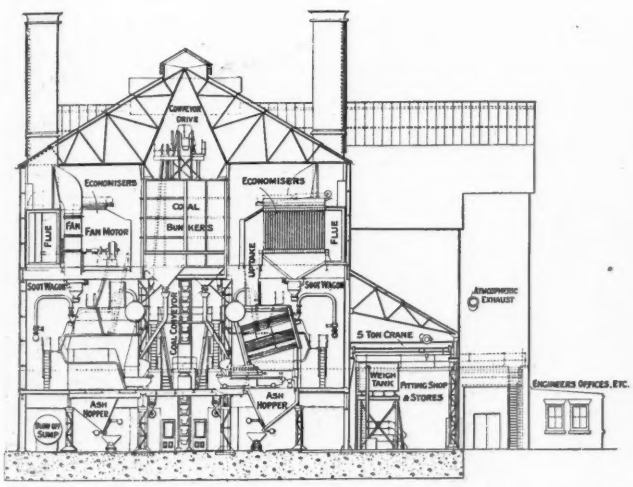
or carried in railway trucks to the quay and dumped into barges. On the next floor are the boilers themselves. The boilers are grouped together in pairs, each boiler having its own superheater and economiser, but the gases from each pair of boilers are dealt with by one separately driven fan and chimney, both placed immediately over the corresponding boilers. Between the economisers, which are arranged overhead in pairs, and down the centre of the boiler house, there are placed extensive coal bunkers which are capable of holding a week's supply of coal, assuming the station to be operated at 50 per cent. load factor. The whole boiler installation is designed so that when working at maximum economy the chimney gases are reduced in temperature to below 300° F.

COAL CONVEYOR; DRIVING END.

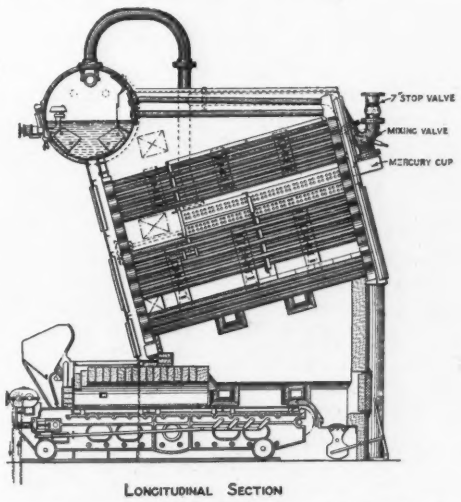


GOVERNOR AND VALVE GEAR OF A.E.G. TURBINE.

The coal, which is delivered to the receiving hoppers by bottom-dumping trucks, first of all goes (if necessary) through a coal breaker, and is then lifted by means of a Babcock & Wilcox conveyor capable of dealing with 40 tons of coal per hour. It may be recollected that, at the Carville power station, it is possible to run the railway sidings right over the boiler houses. On account of the configuration of the land at Dunston, this was not possible, and advantage has been taken of the necessity for a conveyor to install at the end of the boiler house a large coal store capable of accommodating some three weeks' supply of coal, in addition to that in the bunkers over the boilers themselves. The coal store is arranged so as to receive coal when desired from the same conveyor as that which feeds the boiler-house bunkers. Underneath the coal store there is a tunnel in which there are filling hoppers, which again feed into the same conveyor, so that the one conveyor either delivers coal direct to the boiler house bunkers or delivers it to the coal store or takes from the coal store up to the boiler-house bunkers. If it is desired to extend the storage capacity, this can be done by putting additional floors in the coal store, this being of a sufficient height for the purpose. As is well known, it is not possible to store any great depth of coal in one place owing to the risk of its firing, and the storage of coal in layers some 12 ft. deep on separate floors will be a great advantage from this point of view. The coal from the boiler-house bunkers is led by vertical gravity shoots direct into the boiler receiving hoppers, whence it is fed into the boilers by Babcock & Wilcox chain grate stokers, the grate area per boiler being 168 sq. ft. The economisers, of which there is one to each boiler, are situate at the top of the building, where the fans and fan motors are also placed, in a well-lighted and roomy economiser house. The boiler house is arranged with a series of galleries at different heights for water tenders and in order to obtain access to the economisers, fan motors, &c. Each mechanical stoker and each economiser scraper is driven by a separate enclosed electric motor.



SECTION OF ONE BOILER HOUSE.



LONGITUDINAL SECTION

SECTION OF BABCOCK & WILCOX BOILER, MARINE TYPE.

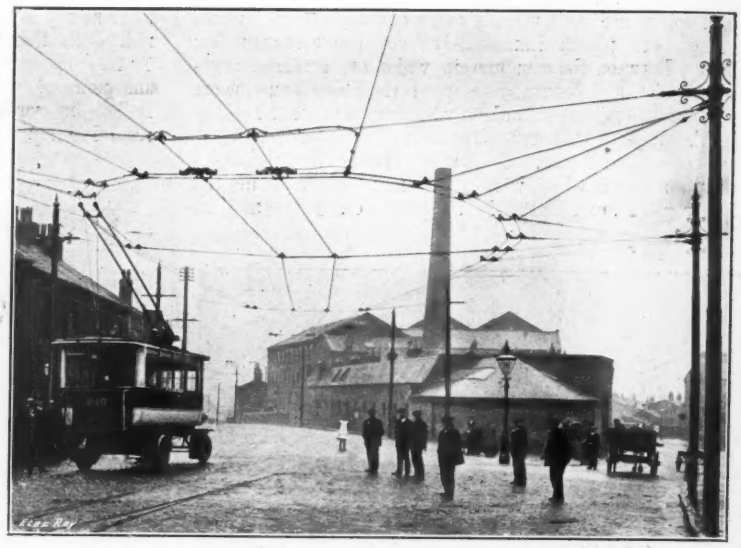
The design, as will be seen later from the drawings, provides that eventually there shall be three end-on boiler houses, each with its own coal store, on the land side of the engine room. The buildings are all steel frame structures, very little brickwork being used at all. All the main switchgear is arranged in a separate building some 150 yards away from the engine house, thus allowing not only of a very light and convenient engine room, but of a switch house into and out of which cables can be taken on any side, thereby greatly facilitating future extensions.

There is one coal store, boiler house, and set of coal-handling plant, for each set of eight boilers, and one boiler house to each two turbo-alternator units. There is one main steam pipe, feed-water pipe, hot-well feed pump, and set of ash-conveying plant for each set of four boilers. There is one economiser and coal shoot for each boiler. Each turbo-alternator unit has its own set of engine-room and boiler-house auxiliaries, supplied with power from an independent "unit" transformer.

(To be continued.)

THE RAILLESS TROLLEY AT LEEDS AND BRADFORD.

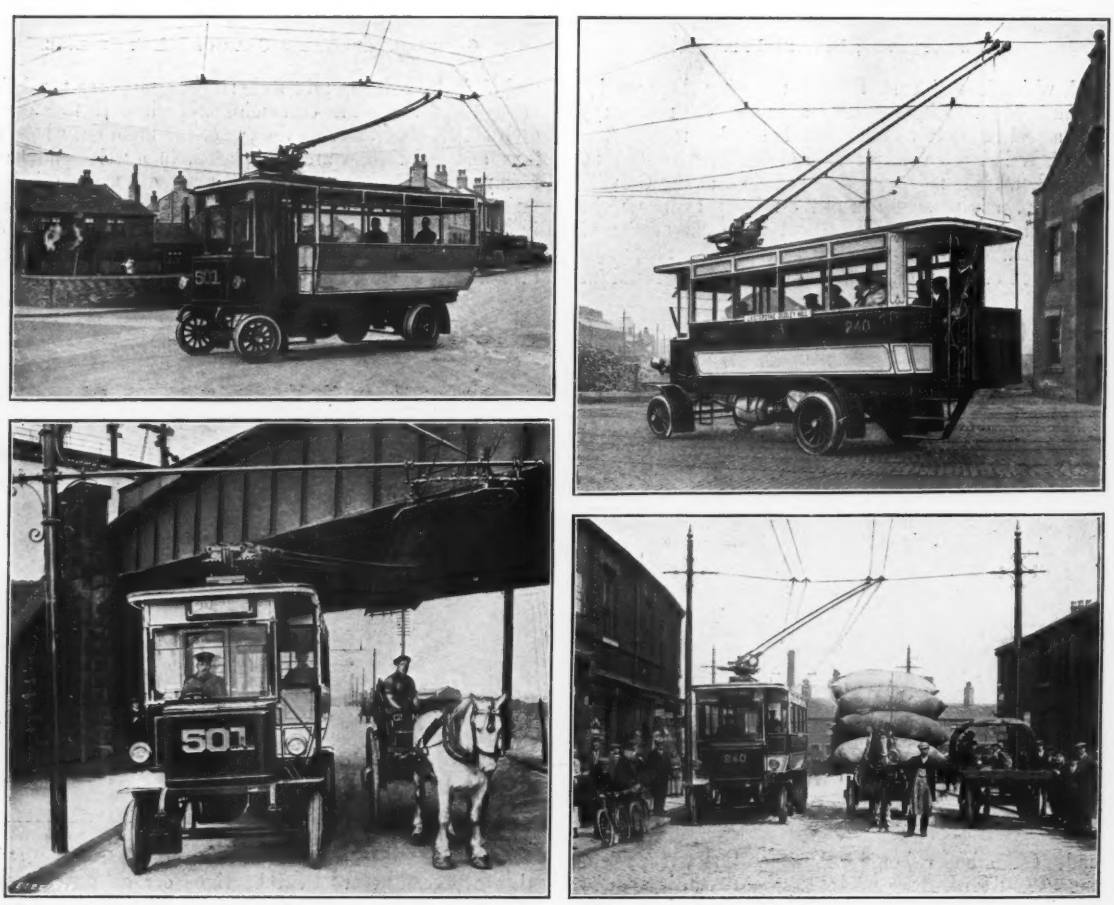
The official opening of the Leeds and Bradford railless trolley systems took place simultaneously on June 20th, the respective Lord Mayors being responsible for inaugurating the two services. At Bradford a route extending from the Thornbury car-shed, along the Leeds Road tramways to the intersection of Laisterdyke, and thence about 1½ miles across to Dudley Hill, has been equipped, while the Leeds system extends from City Square to Farnley, about 3¾ miles, nearly a mile of which is along an existing tramway. In the case of the latter system, the route passes under several railway bridges, one of which we illustrate. The vehicles in each case have been supplied by the Railless Electric Traction Co. London, to the joint specification of Mr. C. J. Spencer and Mr. J. B. Hamilton, the respective general managers of the Bradford and Leeds tramways.



Dudley Hill Terminus, Bradford Railless Trolley System.

Each vehicle provides seating accommodation for 28 passengers, and is equipped with two 20-h.p. Siemens interpolar traction motors with shunted fields, driving through worm-gears and chains to the rear road wheels, which are solid rubber tired.

Series-parallel controllers are fitted, and energy is taken



(Leeds.) (Bradford.)

Views on the Leeds and Bradford Railless Trolley Systems.
(Leeds views by City Tramways Department.)

off the overhead wires by means of a double under-running trolley, as shown in our views. The steering is arranged so that the vehicles will turn round in a radius of 12 ft. measured from the inner rear wheel, and two sets of brakes are provided, one set acting directly on drums on the rear road wheel hubs, and the other, on the countershaft.

There is ample provision for avoiding obstructing vehicles by the railless 'buses, a deviation of 15 ft., centre of trolley wire to centre of vehicle, being possible.

The vehicles which have a wheel base of 13 ft., and an overall width of 7 ft., are fitted with transverse rattan spring seats and polished oak interiors, while outside they are finished similarly to the tramway cars of the respective Corporations.

The overhead equipment, which is similar in many respects to that provided for the tramways, except, of course, as regards the duplicate trolley wires, has cost about £1,250 per mile, while the vehicles cost about the same as single-truck tramway cars.

In conclusion, we are indebted to the managers of the Leeds and Bradford tramways for the illustrations which we publish.

CONTRACTS OPEN.

(*Continued from page* 18.)

Belgium.—The municipal authorities of Jumet have just invited tenders for the supply and laying of armoured cables in connection with the electric lighting undertaking.

Canterbury.—July 12th. Fine coal and large Welsh steam navigation, for a year, for the Corporation Electricity Works. Henry Fielding, town clerk.

Cardiff.—July 14th. Cables, economisers and induced draught installation, for the Corporation. "See Official Notices" June 23rd.

Colchester.—July 15th. 5,000 tons steam coal for the Borough Electricity Committee. Borough Electrical Engineer, 28, Osborne Street.

Cowdenbeath.—July 10th. Diesel oil engine and continuous-current generator, for the T.C. See "Official Notices" June 30th.

Dundalk.—July 24th. Buildings, plant and materials for the electric lighting of the Urban District for the U.D.C. See "Official Notices" to-day.

Eccles.—July 16th. The Corporation is inviting tenders for the high efficiency motor-driven centrifugal pump, duty 63,000 gal., 35 ft. lift per min. Specifications and form of tender (£1 1s. returnable) from H. W. Angus, borough electrical engineer, Cawdor Street, Patricroft.

France.—July 11th. The French Post and Telegraph authorities in Paris (103, Rue de la Grenelle) are inviting tenders for the supply of 15 tons of galvanised iron wire 1 mm. dia., 100 tons ditto 3 mm. dia., and 200 tons ditto 4 mm. dia.

August 1st.—The Prefect of the Department of the Gard, at Nimes, is inviting tenders for the concession for the construction and working of a steam or electric tramway between St. Ambroix and Bagnols.

Ilford.—July 15th. Wiring and fittings for the electric lighting of Cleveland Road School, for the Education Committee. See "Official Notices" to-day.

London.—POPLAR.—July 15th. Overhead coal bunker, coal conveyor, and extension and modification to existing conveyor, at the B.C. electricity works. See "Official Notices" to-day.

L.C.C.—July 19th. Electrical installation at the Hamond Square elementary school. See "Official Notices" to-day.

Newport (Mon.).—July 10th. Best quality small coal for the Corporation Electricity Works, for 3, 6, 9 or 12 months. Borough Electrical Engineer, Town Hall.

Olympia Exhibition.—July 10th. The Executive Committee of the Electrical Exhibition invite estimates for an electrical sign to be fixed outside Olympia for use during the period of the Exhibition. See our advertisement pages for June 30th for further particulars.

Pontypridd.—July 18th. Additional unit at the Treforest refuse destructor for the U.D.C. See "Official Notices" to-day.

Redditch.—July 10th. Single-phase alternator coupled to a Willans steam turbine, condensing plant and pipework, for the U.D.C. See "Official Notices" June 30th.

Salford.—July 17th. One water-tube boiler with superheater, for the Corporation Electricity Department. See "Official Notices" June 30th.

Spain.—The Municipal Authorities of Oalaf (province of Barcelona) have just invited tenders for the concession for the electric lighting of the town during a period of three years.

July 21st.—The authorities of the Government Small Arms Works at Oviedo are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes at the factory during a period of six years.

July 24th.—Tenders may be sent to the offices of the "Gobierno Civil de la Provincia de Lerida," Lerida, for the establishment and working of a telephone system in Cervera.

July 26th.—Tenders are invited ("Gobierno Civil de la Provincia de Santander," Santander) for the establishment and working of a telephone system in Torrelavega.

Stockton-on-Tees.—July 11th. Switches, cut-outs, instruments, &c., for main switchboard, addition to cooling tower, one superheater and one feed water meter, and steam and exhaust pipes and valves, for the Corporation. See "Official Notices" June 30th.

Swinford.—July 10th. Suction gas plants, engines and dynamos, storage battery, &c., switchboard, overhead lines and street lamps, for the R.D.C. See "Official Notices" June 23rd.

Walthamstow.—July 21st. Feeder cables and stoneware conduits for the U.D.C. See "Official Notices" to-day.

York.—July 17th. 2,000 yd. high-tension three-phase underground cable for the City Electricity Department. See "Official Notices" to-day.

CLOSED.

Ashton-under-Lyne.—Messrs. Venner & Co. have received the contract for meters over 10 amperes.

Austria.—The Austrian Siemens-Schuckert Co., of Vienna, have secured a contract for the establishment of a centre electric lighting station in the town of Dux, Bohemia.

Barrow.—Tramways to Biggar Bank.

Steel poles, bases and trimmings.—Messrs. John Spencer, Ltd.
Overhead trolley wire and other fittings.—B.I. and Helsby Cables, Ltd.

Bolton.—The Tramways Committee has accepted the tender of Messrs. J. Booth & Sons for the steelwork required in the erection of the new car repair shed, in Sheffield Street.

Bombay.—The Bombay Electric Supply and Tramways Co., Ltd., has placed an order with the Bastian Meter Co., Ltd., for 300 of their small three ampere meters.

Bristol.—The Docks Committee of the T.C. on Monday accepted the tender of Messrs. Siemens Bros. for cables for the new sheds at Avonmouth.

Dewsbury.—The T.C. has accepted the following tenders:—

Messrs. Cowans, Ltd.—Feeder switchboards.
Messrs. Callender's Cable and Construction Co., Ltd.—Feeder cable.

Glasgow.—The offer of Messrs. Ross & Co. for the supply of the electrical stores for the Trustees of the Clyde Navigation has been accepted.

The T.C.'s Committee on Tramways Works and Stores have recommended the acceptance of the following contracts:—

Dry cells.—Wm. M'Geoch & Co., Ltd.
Tower wagon chassis.—Halley's Industrial Motors, Ltd.
Copper rail bonds.—United States Steel Product Co.
V.I.R. cables.—Liverpool Electric Cable Co., Ltd.
Special track work.—Lorain Steel Co.

Haslingden.—The Corporation has accepted the tender of Messrs. Siemens Bros. & Co., Ltd., for underground cables.

Heckmondwike.—The U.D.C. has accepted the tender of the Houghton Main Colliery Co., Ltd., for 3,500 tons of coal for the Electricity Works, at 7s. 10d. per ton; and that of Henry Lodge, Ltd., for 700 tons, at 7s. 3d. per ton.

Heston and Isleworth.—The tender of Messrs. Krupka and Jacoby has been accepted by the U.D.C., at £80, for the annual supply of metallic-filament lamps for street lighting.

Leyton.—The U.D.C. has accepted the tender of the Union Cable Co., Ltd., at £164, for the supply of turbo-generator connecting cables.

London.—HACKNEY.—The Electricity Committee received the following tenders for yellow flame arc lamp carbons :—

	Price per 1,000 pairs.
Ship Carbons, Ltd. .. .. (accepted)	£3 0 0
Underwood, Manchester, Ltd.	3 0 0
Wm. Geipel & Co. .. .. (accepted)	3 0 0
Chas. W. Webster	3 2 10
Brush Electrical Co., Ltd.	3 4 6
H. G. Mayer & Co.	3 6 6
General Electric Co.	3 15 6
Sloan Electric Co.	3 17 5
Hayman & Co.	3 19 7
Electrical Co., Ltd.	4 14 0
" " .. .. .. (alternative offer)	4 9 0
Crompton & Co.	4 10 3
G. Braulik	4 17 0
Radium Electric Co.	5 2 6

The Committee mentioned that Messrs. Underwood were the agents of Ship Carbons, Ltd., so their tender was not further considered. The contract for 100,000 carbons has therefore been divided equally among the two remaining lowest tenderers.

L.C.C.—During the Whitsuntide recess the Highways Committee received tenders as follows for the overhead equipment of the Brixton to Herne Hill tramways :—

Dick Kerr & Co., Ltd. .. .. (accepted)	£2,093
Clough, Smith & Co., Ltd.	2,148
B. I. and Helsby Cables, Ltd.	2,152
R. W. Blackwell & Co., Ltd.	2,462

An outfit of checking meters for Greenwich generating station is to be obtained from the British Westinghouse Electric Co. at £113., A spare hoisting motor for coaling cranes for Greenwich generating station has been obtained from the Electric Construction Co., Ltd., at £165.

For the supply of compressed air cleaning apparatus and lifting plant for car-sheds the Committee received the following tenders :—

(1) COMPRESSED AIR CLEANING APPARATUS.

Globe Pneumatic Engineering Co., Ltd. .. .. (accepted)	£1,505
Reavell & Co., Ltd.	1,557
Westinghouse Brake Co., Ltd.	1,563
Tilghman's Patent Sand Blast, Co., Ltd.	1,690
Watlington & Co., Ltd.	1,736
Alley & Maclellan, Ltd.	1,934

(2) LIFTING PLANT.

S. H. Heywood & Co., Ltd. .. .. (accepted)	£1,790
East Ferry Road Engineering Works, Ltd.	1,917
Alex. Chaplin & Co. Ltd.	*£65

* Incomplete tender.

SHOREDITCH.—The Lighting Committee has recommended the acceptance of the following tenders for coal :—

J. Hudson & Co. Ltd.—Scotch washed peas, 11s. 5d. per ton.
G. J. Cockerell & Co.—Cowdenbeath washed peas, 11s. 6d. per ton.

For service and arc cable the tenders of Messrs. Siemens Bros. and Co., Ltd., at £108 and £33, have been accepted.

Norwich.—Messrs. Venner & Co. have recently received orders for 334 time switches, bringing the number in use in this town considerably over 400.

Nuneaton. — The T.C. has accepted the following tenders :—

Galloways, Ltd.—Engine and pumps, £1,723.
Heenan & Froude, Ltd.—Refuse destructor, £775.
John Thompson.—Lancashire boiler, £310.

Stoke-on-Trent.—The T.C. has accepted the tender of Messrs. Veritys, Ltd., for electric fittings for King's Hall, at £777.

Wigan.—The T.C. has accepted the following tenders for the annual supply of stores required by the Electric Light and Tramways Departments.

Electric accessories.—General Electric Co.; Eckstein Heap & Co.; Parmiter, Hope & Sugden; British Thomson-Houston Co.
House service boxes.—Henley's Telegraph Works Co.
Carbons.—Morgan Crucible Co.; H. G. Mayer & Co.
Overhead material.—B.I. and Helsby Cables, Ltd.; Watlington & Co.
Brake blocks.—Taylor & Jones.
Tramcar accessories (steel spindles and graphite brushes).—Fleming, Birkby and Goodall.
Tires.—Percy Clark & Co.
Tramcar resistances.—Wallwork & Co.
Springs.—Lion Spring Co.
D.K. armature coils.—P. R. Jackson & Co.
Armature coils.—British Westinghouse Co., Ltd.
D.K. 38N field armature coils.—Dick, Kerr & Co., Ltd.
Armature coils.—P. R. Jackson & Co.
Gear cases.—British Thomson-Houston Co.
Gear wheels.—British Hele-Shaw Clutch Co.
Sundries.—L. Andrew & Co.

The E.L. Committee report having received tenders for the supply of plant to the Pemberton Station. These being considered unsatisfactory the electrical engineer was instructed again to invite tenders for the plant.

Worthing.—Five firms tendered for the additional plant required at the Corporation generating station and these having been examined by the resident electrical engineer, Mr. G. Porter, the T.C., on the recommendation of the Electricity Committee, decided to accept that of Messrs. Mirrlees, Bickerton & Day, Ltd., of Stockport, with generators by Messrs. Bruce Peebles & Co., at £3,965. 21 weeks is the period for the completion of the contract.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—COL. H. M. LEAF.

Orders for the week ending July 15th, 1911 :—

Headquarters will be open from 10 a.m. to 4 p.m. on Monday, Tuesday, Wednesday, Thursday and Friday.
Saturday, July 15th.—The Sheerness detachment will parade at headquarters at 3 p.m. Dress:—Service dress, drill order, with waterbottles and haversacks. Arms will be issued before this parade.
Plymouth Detachment will parade as above at 9.30 a.m. Arms will be issued before the parade.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant for O.C. London Electrical Engineers.

NOTES.

Cab-tire Sheathed Conductors.—An extremely interesting novelty in connection with house wiring was brought forward by the ST. HELENS CABLE AND RUBBER CO., LTD., of Warrington, at the recent Convention of the I.M.E.A. It will be remembered that in our issue of April 22nd, 1910, we described and illustrated the "cab-tire sheathed" trailing cable for coal-cutting machines introduced by the company, who being one of the largest manufacturers of cab tires in the world, conceived the brilliant idea of utilising the wear-resisting qualities of the material for the protection of trailing cables. This application proved most successful; although these cables are exposed to what are probably the most arduous conditions of use known to the electrical industry, being constantly rubbed on rocky surfaces, trodden on, immersed in water, and otherwise ill-treated, we are informed that the makers have never received a single complaint regarding the wearing qualities of the cables, which, moreover, to comply with the rigorous requirements of the Home Office, have to be examined every shift in order to avoid risk of shock to the user. The excellent results obtained prompted the firm to extend the application of the cab-tire sheathing—which, while it contains rubber, and possesses the flexibility and resilience of that material, is not called rubber—and we have before us a specimen of twin flexible for house wiring, which is sheathed with cab-tire. The conductors appear to be 22/36 S.W.G., insulated with pure and vulcanised rubber, and are enclosed in a protective tube of cab-tire material $\frac{1}{16}$-in. thick at the thinnest parts, the overall diameter being $\frac{5}{16}$ in.; the external appearance is very similar to that of compo gaspipe, but leaden in colour. The advantages claimed for it are that it is cable and conduit combined; it can be run in any position, being simply cleated or even stapled up, is perfectly flexible, cannot be kinked even of deliberate purpose, is waterproof and shock proof, takes up the minimum of space, and cannot be injured without the aid of cutting tools. We have stamped on the cord, pinched it flat in a vice, and banged it on a table with the sharp edge of a poker (afterwards cutting it open for inspection) without inflicting the least injury on either the sheathing or the insulated conductors. A cut in the sheathing, made with a knife, does not tend to spread when the cord is twisted or bent in all directions. When exposed to the flame of a match it burns quietly, the flame travelling along the cord at a very slow rate. From the tests we have made we have formed the opinion that this cord possesses excellent qualities, and will prove of great value in reducing the cost of wiring. No reliance is placed upon the sheathing as an insulator. As Mr. Beauchamp said in his paper at the M.E.A. Convention, bad workmen can reduce first-rate material to secondhand quality in the process of erection, but it would be very difficult to damage this cab-tire sheathed material, and we cordially commend it to the notice of all who are interested in cheap wiring. A question may be raised as to its durability; this, we think, is fairly met by the long experience gained with the material for tires, and the makers have exposed it even to the action of ozone for long periods without appreciable effect—one of the most drastic tests to which material containing rubber can be exposed. We are informed that Messrs. Callender's Cable and Construction Co., Ltd., and Messrs. Siemens Bros. & Co., Ltd., are also making this cab-tire sheathed cable, under licence from the St. Helens Co.

Inquiry.—The makers of "Elektra" carbons are asked for.

Appointment Vacant. — Resident engineer for the Dundalk U.D.C. electricity undertaking (£250). See our advertisement pages in this issue.

Croydon Corporation Tramway Sports.—The annual sports of the Croydon Corporation Tramways Athletic Club will be held on Wednesday, July 26th, at 2.30 p.m., on the Brighton Railway Co.'s Athletic Club's Ground, Borough Boundary, Mitcham Road.

Institution Notes.—INSTITUTION OF MUNICIPAL ENGINEERS.—At the annual meeting of the Western District on July 15th, a paper on "Municipal Engineering as a Profession" will be read by Mr. B. Wyand.

IRON AND STEEL INSTITUTE.—At the Turin meeting of October 2nd and 3rd, a number of papers, the subjects of which are now announced, are to be read. One of these is entitled "On the Application of Electrical Energy to the Manufacture of Iron and Steel in Italy" by Cav. Ing. Remo Catani.

Municipal Co-operation with Private Enterprise.—A fresh scheme of proposed municipal co-operation with private enterprise is reported from Darmstadt, where the city authorities have invested £350,000 in electricity works and tramways, but the financial results are far from satisfactory, particularly in the case of the tramways. Not only so, but the extension of the latter is hampered by the suburban steam lines of the South German Railway Co., whilst at the same time the financial situation of the city prevents the raising of capital for the acquisition of the steam lines and their conversion to electric traction, and the construction of new tramways and the development of the electricity works. In these circumstances the city authorities some time ago approached the A.E.G. with a view to securing the company's co-operation in the matter. A draft of a scheme has now been prepared for the formation of a limited company in which shares would be subscribed for by the city and other local authorities, the A.E.G. and the South German Railway Co. The new company would take over the municipal electricity works and tramways, purchase the suburban steam lines in question and erect a large generating station, whilst the town would receive for the lease of its undertakings a sum which would assure the payment of interest on and redemption of the capital expenditure hitherto made. The city would also participate in future increases in the gross receipts and would receive dividends on the shares held by itself. At the end of 30 years the city would have the right of purchase at the book value of all the works erected by the leasing company.

Parliamentary.—BRIGHTON, HOVE AND DISTRICT RAILLESS TRACTION BILL.—This Bill was before the Court of Referees on June 29th, on the question of the *locus standi* of the Brighton Corporation. Mr. Lloyd, K.C., who appeared for the Corporation, explained that the promoters, who were the Brighton Omnibus Co., originally proposed a scheme to run a service of railless trolley vehicles from Portslade, through Hove and Brighton, to Rottingdean. Now it was only proposed to run a service from Brighton to Rottingdean, and the Corporation objected to the truncated service. Brighton already had an experience of isolated systems, and did not want the main approach road to the town occupied with a small system which, he contended, would be unremunerative. Mr. Wedderburn, K.C., for the promoters of the Bill, said all they asked for was to substitute the railless-trolley system for self-contained motors on the road from Brighton to Rottingdean. This route was outside Brighton, and was supported by the Rottingdean people. The Court decided that the *locus* of the Corporation should be restricted to the question of electricity and water mains.

The Royal Assent has been given to the Metropolitan Electric Supply Co. (Acton District) Act, 1911.

In the House of Commons on June 27th, the Telephone Transfer Bill was given a first reading, and the Middlesbrough, Stockton-on-Tees and Thornaby Tramways Bill was read a second time.

In the House of Lords on June 28th, the East Kent Electric Power Bill was read a second time, and the Nottinghamshire and Derbyshire Tramways Bill, and the South Lancashire Tramways Bill, were read a third time and passed. On July 3rd, the L.C.C. (Tramways and Improvements) Bill and the Metropolitan Electric Tramways Bill were read a second time. On July 4th, the Bristol Tramways Bill was read a second time.

A Walking Race for the Electrical Trade.—A London-to-Brighton walking race open to all amateurs employed in the electrical trades will take place on Saturday, July 29th. We are informed that although most of the prominent long-distance walkers in England to-day are connected with the electrical trade, notably H. V. L. Ross, T. Dumbill, F. E. Roberts, W. Brown, &c., it is not to encourage the champions that the walk is being promoted, for the prizes for the novice section will be quite as numerous and valuable as the scratch prizes, while it is also proposed to present time certificates to all who complete the walk in under 10½ hours, as a memento of the event. Donations to the prize fund are being solicited from employers and others, and the promoters would be glad of further assistance on the committee from enthusiasts. The entrance fee will be 3s., and entry forms will be ready in a few days. We understand that the General Electric Co., Ltd., has offered an "Osram" trophy of the minimum value of £5, the value to be increased according to the support accorded to the event; other donations have been either promised or given. A further sum of about £30 is required, while all cyclists who are willing to assist on the day as attendants to the competitors, &c., and gentlemen willing to assist with their motor-cars, are asked to communicate with the hon. sec., Mr. S. C. Haynes, May-Oatway Fire Appliances, Ltd., 92-4, Paul Street, London, E.C.

Electrical Contractors' Association (Inc.) Annual Dinner.—On Monday last the annual dinner of the Association was held at Frascati's; Mr. G. Harland Bowden presided over a gathering of about 100 members and guests. After the loyal toasts had been heartily honoured, Mr. R. Tweedy Smith proposed the "Houses of Parliament," referring to his own aspirations in that direction, and emphasising the necessity of putting the utmost pressure upon Members to prevent the undue extension of municipal trading. Mr. H. Terrell, K.C., who was to have replied, wrote regretting that he was compelled to attend at the House of Commons.

Mr. H. H. Berry, proposing the "Electrical Contractors' Association," said the Association had had a most successful year. Mr. Bowden had travelled the country building up a fighting fund, with which they would be able to fight a coming Bill. They had done well to choose him as President for a second year.

The toast was drunk with musical honours, and the President, in his reply, said they had increased their membership during the past year by 20 per cent. He had had a gratifying reception in all parts of the country, and the result was that a handsome sum was at their disposal, and the sources were not exhausted. Seeing that members of the M.E.A. had proved themselves good friends to the contractors, was it not a pity that friendly relations could not be established between the two Associations? He was sure that they, as well as the contractors, were disappointed at the negative result of the Conference. The rock upon which they split was the fact that while the policy of the contractors must be to fight in order to retain the means of livelihood, that of the municipal electrical engineers led in the direction of municipal trading. He wished the British public could be educated to realise the point at issue. The municipal engineer had done his work well in cheapening electric light, power and traction, but could it be right for the municipality to enter private premises and carry out work, cutting out the contractor, who was himself a ratepayer? They were fighting in the last ditch, against a most unfair form of competition. He cited the recent united action of the medical profession as a parallel case (which we may say, however, it is not). The British public must be educated to understand the position of the contractor, and the members of the Association must show steadfastness of purpose and devoted loyalty to the Association, not attaching undue importance to local interests.

Mr. Rawlings proposed "The Institution of Electrical Engineers, the Cable-Makers' Association, the National Electrical Manufacturers' Association, and kindred associations," expressing gratitude to the I.E.E. for valuable assistance, especially for the Wiring Rules; to the cable-makers for maintaining the standard of quality in the face of severe competition; to the (late) president of the M.E.A., remarking that if it were guided by such men the contractors need have no fear; and to the National Electrical Manufacturers' Association, suggesting that the manufacturer was at present the only member of the industry making any money, and acknowledging the good work done by the Association. He proposed that the next organised debate should deal with the question "when does a manufacturer become a contractor," and *vice versâ*. Mr. Ll. B. Atkinson, in reply, pointed out that Herbert Spencer had shown that all development was from the simple to the complex, and that this could be observed in the electrical industries. The Institution, in his opinion, had done wisely in avoiding commercial questions, which could be more usefully dealt with by the various associations performing specialised functions, and he asked them to look upon the formation of these associations as a stage in the development towards a higher and more complete organisation, to the advantage of the whole industry. Mr. F. H. Nalder, President of the N.E.M.A., replied for that body, denying that manufacturers were any better off than others in the electrical industry, and pointing out that negotiations between representatives of the different associations had often produced happy results for all parties. Mr. E. C. Wallis, in eulogistic terms, proposed "The Health of the President," who, in reply, expressed his gratification at the hearty reception of the toast and on his re-election as President, remarking that he was sufficiently rewarded by the cordial support of the members, which he sincerely appreciated. The proceedings were enlivened by a programme of music and recitation, under the direction of Mr. Richard Triggs.

Annual Outing.—The annual outing of the St. Pancras B.C. generating station's staff took place on Saturday, July 1st, to Brighton. As many as possible of the staff were present, and dinner was served at the Washington Hotel, with Mr. J. T. Baron, the supervising engineer, in the chair. After the usual loyal toast the chairman proposed the "Success of the Undertaking," coupling with it the name of Mr. Sutton, senior shift engineer of King's Road Works, who also acted as hon. secretary and treasurer of the outing. Mr. Sutton suitably replied, and then proposed the health of Mr. Baron, their immediate chief, who, he said, they were most pleased to see with them. Mr. Baron, on replying, was received with cheers, thanked them, and expressed himself highly gratified with the general good feeling existing.

Liverpool Tramway Sports.—The eighth annual amateur athletic sports, promoted by the Liverpool Corporation Tramway Employés' Social and Thrift Society, were successfully held at the society's ground in Green Lane, on Thursday and Friday, June 29th and 30th, under the honorary presidency of Mr. C. W. Mallins, tramways general manager. The Lady Petrie Cycle Challenge Trophy, competed for by branches of the society, was won by the holders (Walton). The prizes were presented by Lady Petrie, wife of the chairman of the Tramways Committee.

Electrical Mill Driving.—The Textile Institute, which has its headquarters in Manchester, has decided to co-operate with the I.E.E. in making a general investigation into the application of electricity in textile mills at home, on the Continent, and in America. A committee of 28 (14 from each Institute) is being formed.

The Reduction of Staff in Germany.—The question of the reduction in the staff at the Frankfort dynamo works, as a result of the transfer of the latter to the A.E.G., was raised at the recent meeting of the Felten & Guilleaume-Karlswerk, of Mulheim. As the company's accounts included the officials' provident fund, a shareholder pointed out that, in consequence of the amalgamation of the works with the A.E.G., a number of officials had been deprived of employment and 200 were given notice at the end of March, who had, in part, been employed at the Frankfort works for years. Some of the officials had addressed a petition to the directors, asking that a portion of the provident fund should be devoted to the support of

the officials who had become out of work, and the shareholders asked whether the directors would be prepared to grant the request. Dr. Gnauth, who replied to the question, is reported to have stated that the promise given at the meeting held last October had been kept, and the directors had continued to pay the salaries of those officials who had lost their positions through discharge, until the acquisition of a new situation. Nevertheless, the number of requests which had reached the directors was comparatively small, and that probably justified the conclusion that the number of necessitous cases also was not very large. This was also confirmed by what the speaker had heard in regard to how many officials of the Frankfort works had found occupation with the A.E.G. and elsewhere. If the number of requests had been small that was also due to the circumstance that the A.E.G. had afforded the opportunity to the officials of seeking other employment by continuing to pay salaries far beyond its legal obligations. The directors of the Felten & Guilleaume Co. continued to grant support to the unemployed officials in cases of necessity, but the question of utilising the provident fund for the purpose was quite another matter. Negotiations on the subject would have to be conducted between the company and the A.E.G., but they would be difficult, as the proposal was not a claim which could be legally put forward.

Dunston Power Station.—On Wednesday, by invitation of the Newcastle-upon-Tyne Electric Supply and the County of Durham Companies, an inspection of this new generating station, of which we commence a description elsewhere in this issue, was made by a large party of gentlemen. Luncheon was subsequently served at Newcastle, Dr. J. T. Merz receiving the guests; the company included Mr. S. Z. de Ferranti, who proposed the toast, "Electric Power Supply," to which the chairman replied. We shall report the event more fully in our next issue.

The Batti-Wallahs.—Arrangements have been made for the Batti-Wallahs' Society to visit and inspect the R.M.S. *Olympic* at Southampton on July 29th. The party will be subsequently entertained at lunch by the President, Mr. W. Slade Olver, on board the Royal Motor Club yacht *Enchantress*, and will witness a regatta in the afternoon.

£30,000 Gift for Chemical Laboratories.—Mr. Ralph Collingwood Forster, J.P., of The Grange, Sutton, who has already given £4,500 to complete the site for the new chemical laboratories at University College, has written to Prince Arthur of Connaught, the president of the Appeal Committee, intimating his intention to commemorate Coronation year by making a further gift of £30,000 to the College, in the hope that the building of the laboratories may be speedily proceeded with.

The Brighton Metropole Illuminations.—The most attractive hotel illuminations in Brighton, during the Coronation, were those on the Hotel Metropole, where some 2,200 Ediswan lamps were employed, the installation having been carried out by the hotel staff under Mr. Mahood, the electrical engineer. This building was in marked contrast to its neighbour, the Grand, which relied on "the lively flicker and sparkle of gas," as an interested contemporary has it.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. G. WARING has been appointed to the position of shift engineer of the Eccles Corporation, in place of Mr. E. J. Ward, resigned.

MR. P. J. S. TIDDEMAN, late electrical engineer to the former Stoke-on-Trent T.C., has withdrawn his appeal to the treasury for compensation for loss of office owing to the Federation scheme.

The Loughborough T.C. on Monday decided to increase the salary of MR. J. H. DENT, and to appoint him deputy electrical engineer.

The Croydon B.C. has agreed that the salary of the borough electrical engineer (MR. A. C. CRAMB), £600, be increased by £50 a year, rising to £800; and that the salary of the assistant engineer be increased by two instalments of £25 each to £350.

On June 27th the staff of the Farnworth U.D.C. electricity and destructor works presented MR. A. J. HUTCHINSON, the chief engineer and manager, with a marble timepiece, suitably inscribed, to celebrate the occasion of his marriage, which was to take place on 29th ult. The presentation was made by Mr. W. Phethean, the chief assistant engineer, supported by Mr. W. E. Waters, secretary, and other members of the staff.

The Finance Committee of the Burnley Corporation has recommended that the salary of MR. J. E. STARKIE, borough electrical engineer, be advanced from £350 to £400 per annum.

Tramway Officials.—The Halifax Tramways Committee has recommended the T.C. to increase the salary of MR. J. W. GALLOWAY, engineer, from £250 to £275 per annum.

General.—MR. J. DOUGLAS COLLIER has just arrived in this country from Japan. His visit chiefly relates to the order recently placed with his firm (Messrs. L. J. Healing & Co., Ltd., Japan) by the Imperial Government, for a 10,000-H.P. gas-driven generating station to be installed on the new electrified line between Tokio and Yokohama. Mr. Collier expects to be here for several months before returning to Japan, and correspondence intended for him should be addressed, c/o Messrs. Tozer, Kemsley and Fisher, Ltd., 84, Fenchurch Street, London, E.C.

MR. J. G. LORRAIN, consulting engineer and patent agent, has removed to Staple Inn Buildings, Holborn, London, W.C.

The Royal Society of Arts has awarded its Albert Medal to the HON. SIR CHARLES A. PARSONS, K.C.B., F.R.S., for his experimental researches into the laws governing the efficient action of steam in engines of the turbine type.

Consequent upon the retirement of MR. STEINITZ, the following staff changes are announced by the Brush Electrical Engineering Co., Ltd.: MR. B. BROADHURST is appointed general manager, with headquarters at Loughborough; MR. W. JOHNSTONE is appointed assistant manager, with headquarters in London; MR. G. S. WOOD (at present works manager at the Witton Works of the General Electric Co.) is appointed works manager at Loughborough.

The Bridlington T.C. has appointed MR. FRED. WHITELEY, of Leeds, as electrician at the Royal Prince's Parade.

The Southampton Harbour Board has appointed MR. G. E. TILLING as electrician.

MR. P. C. JONES has resigned his position as control gear sales engineer to the British Westinghouse Co., and joined Messrs. Allen West & Co., Ltd., of Brighton, in a similar capacity.

Obituary.—We regret to record that MR JOHN GILLEY, who was with the Foster Engineering Co., Ltd., from the commencement, and was their first outside representative, died on June 14th from consumption. Mr. Gilley had many friends in the trade.

MR. F. E. BAINES.—We regret to learn that Mr. F. E. Baines, C.B., who for some 40 years filled various important offices in the General Post Office, including that of Assistant Secretary and that of Surveyor-General of Telegraphs, passed away on Tuesday last at Hampstead, aged 79 years.

DR. G. JOHNSTONE STONEY, F.R.S.—We regret to learn from the *Times*, just as we go to press, that Dr. George Johnstone Stoney, Sc.D., F.R.S., passed away on Wednesday morning, at the advanced age of 85 years. Dr. Stoney was a president of Section A of the British Association, and he served on the Committee of that Association which, many years ago, decided on the C.G.S. system of units, and he is credited with being the first to suggest the name "electron." He had been a Fellow of the Royal Society since 1861. His eldest son is Mr. Gerald Stoney, who, as manager of the Parsons turbine works, is well known to, and esteemed by, so many electrical and other engineers.

NEW COMPANIES REGISTERED.

Record Electrical Co., Ltd. (116,488).—This company was registered on June 24th, with a capital of £20,000 in £1 shares (10,000 preference), to carry on the business of manufacturers of and dealers in electrical machinery and appliances, electric measuring instruments, meters, wires, cables and other apparatus and appliances, &c., and to adopt an agreement between C. W. von Roemer, J. W. Record and T. J. Boorne. The subscribers (with one share each) are:—J. W. Record, 5, Beech Avenue, Gatley, Cheshire, electrical engineer; T. J. Boorne, 34, Marlborough Road, Wimbledon Park, S.W., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are J. W. Record, managing director, and others to be appointed by the subscribers; qualification, £500; remuneration as fixed by the company. Registered by Waterlow & Sons, Ltd., London Wall, E.C.

W. C. Tackley & Co., Ltd. (116,522).—This company was registered on June 27th, with a capital of £500 in £1 shares, to carry on the business of electrical and mechanical engineers, electricians, manufacturers of and dealers in electrical equipment and machinery, &c. The subscribers (with one share each) are:—T. M. Marris, 25, Ingersoll Road, Shepherd's Bush, W., secretary; A. E. Lees, 2, Livingstone Road, Palmers Green, N., director. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; no qualification necessary. Registered by Arthur Benjamin & Cohen, College Hill Chambers, E.C.

F. G. Edey & Co., Ltd. (116,551).—This company was registered on June 29th, with a capital of £3,000 in £1 shares, to take over part of the assets of the business carried on by F. G. Edey & Co. at 25, Warwick Lane, E.C., and to carry on the business of electrical engineers and contractors, suppliers of electricity, &c. The subscribers (with one share each) are:—F. E. Edey, 25, Warwick Lane, E.C., electrical engineer; D. Edey, 25, Warwick Lane, E.C., electrical engineer. Private company. The first directors are F. E. Edey and D. Edey. Registered office, 25, Warwick Lane, E.C.

Corona Lamp Works, Ltd.—(116,527).—This company was registered on June 28th, with a capital of £2,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, electric lamps, fittings, bells, batteries, accumulators and electrical accessories, &c., to acquire the business carried on at 10, Ascham Street, Kentish Town, and at 47 and 51, Standen Road, Southfields, as the Corona Lamp Works Co., and to adopt an agreement with G. N. Ogilvie. The subscribers (with one share each) are:—G. N. Ogilvie, 13, Buckingham Gate, S.W., electrical engineer; A. N. C. Mackley, 36, Victoria Street, S.W., engineer. Private company. The number of directors is not to be less than two or more than five; the first are G. N. Ogilvie (chairman and managing director) and A. N. C. Mackley; qualification, £10; remuneration, £200 each per annum. Registered office, 10, Ascham Street, Kentish Town, N.W.

British Arc Welding Co. (North-East Coast) Ltd. (116,568).—This company was registered on June 30th, with a capital of £20,000 in £1 shares, to take over a process for electrical welding under a grant or licence given by the British Arc Welding Co., Ltd., to R. F. Brigham and R. Cowan. The subscribers (with one share each) are:—R. F. Brigham, 186, Westoe Road, South Shields, engineer and ship repairer; R. Cowan, Grosvenor Road, Westoe, South Shields, engineer and ship repairer. Private company. The number of directors is not to be less than two or more than six; the first are R. F. Brigham and R. Cowan (managing directors for 10 years). The British Arc Welding Co., Ltd., have the right to one nominee on the board; qualification, £400. Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C.

CITY NOTES.

General Electric Co., Ltd.

THE report of the directors for the year ended March 31st, 1911, to be submitted at the meeting to be held at 67, Queen Victoria Street, E.C., on Monday, July 17th, is as follows :—

The net trading profits and income from investments, &c., amount to £119,146, to which must be added balance brought forward from last account, £8,919, making a total available profit of £128,065. After deducting debenture interest and depreciation amounting to £32,331, there remains a balance of £95,734, out of which the dividend on the preference shares at the rate of 5 per cent. for the year ended March 31st, 1911, has been paid, absorbing £12,500, and there is transferred to reserve account, £43,616, leaving an available balance of £39,618, which the directors recommend should be appropriated as follows : Provision for managing director's and employés' bonus, £7,431 ; provision for dividend on ordinary shares at the rate of 5 per cent. for the year ended March 31st, 1911, £19,973 ; balance to be carried forward, £12,214. The reserve account is as follows : The balance at March 31st, 1910, was £158,488, to which has been added out of profit for the year ended March 31st, 1911, £43,616, giving a total reserve account of £202,104. Out of this amount the directors have decided to apply towards writing down goodwill and patents the sum of £92,104, leaving a total reserve account of £110,000. The directors have to record with deep regret the death during the year of their late chairman and managing director, Mr. G. Byng.

"The result of the trading for the year to March 31st, 1911, has been satisfactory. The factories at Witton, Salford, Birmingham and London have been well employed during the year. The removal of all manufacturing departments other than telephone and telegraph apparatus from Salford to Witton has been completed, the central stores from Manchester have also been removed to Witton. The additional capital expenditure incurred during the year has been principally devoted to the housing of these departments. The investment account comprises mainly investments in undertakings owned or controlled by this company, and is developing to the satisfaction of the directors. Further ordinary shares to the number of 1,156 have been allotted during the period covered by the accounts, to the directors and staff at par. Mr. L. G. Byng, and Dr. A. H. Railing, who were appointed directors by resolutions of the board, dated January 16th, 1911, and April 11th, 1911, respectively, being eligible, offer themselves for re-election.

Mr. E. G. Byng also offers himself for election.

For the interest of our readers we give below the comparable figures from the reports for the three years ended March, 1909, 1910 and 1911 :—

	1909.	1910.	1911.
Net trading profit and income from investments	£78,201	£95,462	**£119,146**
Depreciation and deb. interest ...	26,987	27,057	**32,331**
Balance	51,213	68,404	**95,734**
Pref. div., 5 per cent. for the year	12,500	12,500	**12,500**
Available balance	38,713	55,904	**83,233**
Managing director's and employés' bonus	3,871	5,590	**7,431**
Ordinary dividend, 5 per cent. ...	18,697	19,395	**19,973**
To reserve account...	16,145	22,000	**43,615**
Balance carried forward	—	8,919	**12,214**
Reserve fund total...	£136,488	£158,488	**£202,104***

* As £92,104 of this is now applied towards writing down goodwill and patents, the total reserve is £110,000.

Goodwill and patents now stand at £1 in the balance-sheet.

The company's investments consist of debentures, stocks and shares to the amount of £121,556, and the income upon these was £11,280 for the year. Sundry creditors stand at £218,620 ; sundry debtors at £402,227 ; stock in trade at £340,138 ; and bank balances and cash in hand amount to £56,744. We congratulate the General Electric Co. upon doing a record year's business, also upon their conservative policy in handling the profits. The temptation to pay a big dividend on the ordinary shares has been resisted, and the distribution is continued at the rate of only 5 per cent., the large balance of profit being put to reserve, and from reserve being applied, with the assistance of other moneys taken from that fund, to the wiping out of goodwill and patents.

Mexican Light and Power Co.—A dividend of 1 per cent. on the ordinary shares is payable July 15th.

Eastern Telegraph Co., Ltd.—The directors have declared a dividend at the rate of 3½ per cent. per annum on the preference stock, for the quarter to June 30th, and a first quarterly interim dividend of 1¼ per cent. on the ordinary stock.

Indo-European Telegraph Co., Ltd. — An extraordinary general meeting was held on June 28th, at which new articles of association were adopted.

Edmundsons' Electricity Corporation, Ltd.

THE report of the directors for the year ended March 31st, 1911, to be presented at the annual meeting on July 13th, states that the net profit, after payment of interest on the debenture and prior lien debenture stocks, amount to £16,138, as compared with £10,768 last year. Adding to this amount the balance of £25,578 brought forward from the last year, there remains the sum of £41,716, which the directors recommend should be carried to reserve. The gross trading profit has increased by £2,335. The dividends and interest received have increased by £4,068, and the Urban Co. guarantee is less by £854, whilst the loss on working the local authorities' undertakings is increased by £1,871, the greater part of which is due to payments for interest and sinking fund on sums paid to this company in respect of work carried out during previous years. The investments in and advances to subsidiary and other companies amount to :—Shares, £790,004 ; debentures, £220,098 ; advances, £492,659 = £1,502,761. The following are the gross profits of subsidiary and other companies for the years 1909 and 1910 :—

Name.	Gross profit (before providing for capital charges and depreciation). 1910.	1909.	Lamps connected (equiv. 33-watt). 1910.	1909.
Alderley	£2,213	£1,792	21,377	19,114
Bromley	12,693	12,512	95,307	89,282
Folkestone	15,465	14,049	118,049	111,748
Guernsey	5,526	5,696	95,833	90,079
Isle of Wight	12,367	11,396	107,028	98,997
Ilfracombe	1,029	1,154	16,607	18,960
Lymington	1,588	1,602	17,370	17,843
Melton Mowbray ..	2,215	2,004	19,889	18,074
Newmarket	2,401	2,494	25,988	24,448
North of Scotland ..	5,097	4,016	66,597	59,864
Ramsgate	1,902	1,909	31,661	27,372
Scarboro' Trams ..	—39	—677	—	—
Salisbury	5,974	5,739	37,813	35,797
Urban Co...	45,300	43,113	525,160	476,596
Winchester	7,114	6,921	60,235	56,658
Wycombe	4,931	4,823	53,379	51,025
Cromer	909	924	13,430	12,466
Dorking	1,767	1,862	18,863	17,308
Frome	907	1,266	33,153	30,199
Hamilton	2,695	2,905	48,670	43,106
Surbiton	3,615	3,839	35,974	39,758
Total	£135,669 (Inc. £6,339)	£129,339	1,441,883 (Inc. 107,299)	1,334,584

The total capital expenditure in the above undertakings has increased from £2,825,225 to £2,911,080 (Inc. £85,855).

Greenwood & Batley, Ltd.—In their report the directors state that, after providing for interest on the debentures, expenses of management and doubtful debts, the accounts for the year to March 31st show a profit of £20,198, plus £2,211 brought forward, making £22,409. In reference to the subsidiary and connected companies, although some of these give satisfactory results, the directors consider it advisable to depreciate and also to provide for a possible loss in connection with others, and for this purpose they have transferred the sum of £10,000 from the reserve, together with £3,000 from the above balance. This leaves £19,409 to the credit of profit and loss, out of which £10,000 has been written off for depreciation. A dividend for the year at the rate of 7 per cent. per annum on the paid-up cumulative preference share capital, absorbs £7,027, and leaves a balance of £2,381 to be carried forward. The works have been maintained in a high state of efficiency, and are well employed at the present time.

Prospectuses.—*Canadian P. J. Mitchell Co., Ltd.*—We have received a copy of the prospectus of this company, the registration of which was recently recorded in our "New Companies" section (ELECTRICAL REVIEW, June 23rd, p. 1010). The company will acquire the goodwill of the business connection and organisation established in Canada by Mr. P. J. Mitchell, of Caxton House, S.W., including that in connection with the supply of Rateau patent exhaust steam plants, and the agenies held by him in Canada for a number of important firms (among them Greenwood and Batley, Ltd., Lassen & Hjort, Higginbottom & Mannock, Ltd., and others). The purchase price is £1,000, payable in 20,000 fully paid ordinary shares of 1s. each ; there is no cash payment ; 20,000 6 per cent. preference shares are offered for subscription. Among the agreements mentioned in the prospectus is one whereunder Mr. Archibald Parker Smith will act as general manager of the company in Canada, and one appointing Mr. W. Armstrong technical manager in Canada, both for a period of two years, at £500 per annum each.

Metropolitan District and London Electric Railways Joint Power House Rent Charge Stock.—The subscription list is to close to-day in the above 4 per cent. stock offered for sale at par by Messrs. Speyer Bros.

The Tri-State Railway and Electric Co., Ohio.—The Municipal and General Securities Co., Ltd., have been offering for sale $668,000 6 per cent. bonds to bearer of $1,000 each at 95 per cent., with a bonus of 25 per cent. common stock. The operating managers are Messrs. J. G. White & Co., of New York

Continental.—FRANCE.—La Société de l'Energie Electrique de la Basse Loire, of Paris, is increasing its capital from £48,000 to £80,000.

J. G. White & Co., Ltd.

The annual meeting was held on Thursday last week at the offices, 9, Cloak Lane, Cannon Street, E.C., Mr. J. G. White presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 1053), said that at the last annual meeting they were able to allocate to reserve and dividends the largest profits in the company's history. That day they were able to congratulate one another on further progress; the net profit for the year having amounted to £91,466, as against £64,801 for the previous year. Not only was this profit by far the largest ever shown by the company, but the increase over the preceding year was also the largest ever made. It was, however, as stated last year, not to be expected that profits so large as these could be realised every year, the results of the period under review having exceeded their own expectations. At the same time they still considered the position of the business in hand as being quite satisfactory and the outlook most encouraging. Referring to the balance-sheet, they would note that the quick assets of the company in the form of cash and loans against securities amounted to £136,332, an increase of about £18,000 over the figures shown in the preceding year. This quick asset item was nearly double the total single creditor item on the other side of the balance-sheet, although this latter item included certain considerable contingent provisions; so that this cash, and practically cash item, was more than double the actual total debts. The item of sundry creditors of £71,897 was larger than last year, indicating an increase in the business. The figure for investments stood at £150,781, which was also considerably more than twice the company's total debts. This item showed an increase of approximately £28,000 over last year. Their investments in associated companies were practically fixed and permanent, and included a controlling interest in the shares of the Building Construction Co., Ltd., which had built a number of the most important buildings in London. During the past year a considerable new investment in this class was made by the formation of the Municipal and General Securities Co., Ltd., with a capital of £50,000, all owned by this company (and now having a surplus of over £12,000), to carry on a general financial business in the purchase, sale, and issue of securities. The first half-year of this Securities Co.'s operations had been most successful. The aggregate par value of shares of this class owned by the company was about £152,000, included in the balance-sheet at under £87,000. The syndicate class of investments were usually taken in connection with efforts to secure new business, either financial or engineering. They made a general practice of immediately writing down each such investment to a nominal value of £1 regardless of cost. As a consequence the balance-sheet value of this class aggregated some £10, although the total par values exceeded £20,000. The general investments were the securities taken in connection with contracts or promotions, or purchased with the expectation of selling at a profit. The financial profit previously mentioned had resulted largely from the sale during the past year of securities in this class. As to present valuations of this class, personally, he should not be willing to see the lot sold at double balance-sheet figures. The dividends received during the year on securities owned (omitting one large dividend from a syndicate now in liquidation which could not be considered as a regularly recurring item), amounted to £12,439, or 8·2 per cent. on the present total of the investment account, and more than sufficient to pay 6 per cent. dividends on the company's entire preference and ordinary share capital. They would understand that the company's financial department was becoming increasingly important. Growth in this direction was likely to continue. This had been accomplished by departmentalising, and without interfering with the efficiency of the company's engineering and construction departments. On the contrary, they believed that these departments were better able than ever before to undertake a wide range of engineering and construction work, partly because of the increasing experience of the engineering and construction staff, and partly due to the wider scope of work undertaken. Recently additions to these departments had been made of men specially skilled in designing and supervising the construction of hydro-electric and other water-power developments, water supply systems, sewage disposal plants, &c. This general field of engineering should become increasingly important to the company. During the year increased business in the operation of tramways and electric lighting properties resulted in the formation of a separate department for the operating management of these and similar companies. This department was now prepared to furnish offices, board room accommodation and secretarial services, as well as expert advice to boards of directors, to purchase at low prices supplies and materials needed for companies managed, and generally to assist in working out efficient and economical management for properties, and to substantially aid in their progressive and systematic development. The items of sundry debtors and works in progress, aggregating £158,596, also showed an increase over the last account. This, like the increased creditors, indicated the greater volume of work in hand in their engineering department. Plant, instruments, and stock of materials, now stood at the nominal valuation of £1, which valuation spoke for itself. Purchase of business stood at £15,000, to which figure it was written down from £47,975 out of the profits of the previous year. They were proposing this year to wipe this account out altogether, though his personal opinion was that in future balance-sheets the item should appear at a nominal figure of £1. Referring to the profit and loss account, there was no item which required any comment, except, perhaps, the figure of £12,057, "percentage to directors and staff." The principles behind this item were fully explained to them last year. The directors in charge and the staff had earned their contingent salaries, and were quite entitled to share in their prosperity. The next point was the distribution of the remaining profits for the year. They believed in a generally conservative policy with reference to dividends. The strong position of the company at the present time was to a considerable extent due to the building up of substantial reserves out of profits. During the 10½ years of the company's life, including the distribution recommended in the report, the company would have paid out in dividends £160,708, and had retained in the business out of profits £182,787. This surplus had been mainly contributed by the ordinary shareholders for the benefit of the company as a whole. Had all the company's profits for the last five years been distributed to shareholders, leaving the reserve at about £57,000, the preference shareholders would have received, including the proposed dividends for July 1st next, a total of 60 per cent. instead of 45 per cent., and the ordinary shareholders would have received 302 per cent. instead of 95 per cent. In other words, after allowing for proposed dividends, the preference shareholders had contributed to the surplus remaining in the business 15 per cent. on the par value of their shares, and the ordinary shareholders 207 per cent. The directors believed in continuing the policy of building up reserves, and, therefore, proposed that of the sum of £88,812 now available for distribution, £15,000 be allocated to writing off the balance of purchase of business account, and a further £15,000 be placed to the credit of a new reserve account for the equalisation of future dividends. This total sum of £30,000 having been set aside, the directors felt justified in recommending a dividend of 7 per cent. for the half-year on both the preferred and ordinary shares, making with the interim dividend of 5 per cent. paid January 1st, a total distribution of 12 per cent. for the year. As they knew, the preferred shares were cumulative as to 6 per cent., and thereafter they shared with the ordinary up to a total distribution of 12 per cent., the ordinary being entitled to remaining surplus profits. They further recommended an extra dividend of 10s. per share, or 50 per cent. on the ordinary shares, making a total of 62 per cent. for the year, leaving a balance of £19,813 to be carried forward to next year's accounts. In this connection they might note that the amounts added to reserve, writing down of goodwill, and increase in carry forward, exceeded 60 per cent. on the ordinary shares.

Mr. J. B. White seconded the motion, and the report was adopted.

Chili Telephone Co., Ltd.—The report of the directors for the year ended March 31st, 1911, states that the aggregate number of subscribers at all centres at the end of the year was 9,919, as compared with 8,818 at the beginning, or a gain of 1,101. The gross revenue in Chile from all sources was: In 1910-11 $2,041,198, in 1909-10 $1,851,689, an increase of $189,509. The expenditure in Chile was: In 1910-11 $976,570, in 1909-10 $926,387, an increase of $550,183. The net income in Chile from all sources was: In 1910-11 $1,064,627, and in 1909-10 $925,301, an increase of $139,326. The average rate of exchange for the year was 10·90d., as compared with 10·49d. in the previous year, giving an increase for the year of 0·41d. Converted into sterling at these rates, the figures given above are: In 1910-11 £48,357, in 1909-10 £40,411, an increase of £7,946. The liquid assets and liabilities in Chile on March 31st, 1911, were valued at 10½d., the current rate of exchange on that day, the same rate at which they were valued on the corresponding date of the previous year. The balance to the credit of the revenue account, including £2,987 brought from the previous year, is £49,131, of which £22,805 has been carried to reserve. An interim dividend of 3s. per share, free of income-tax, was paid on January 15th last, and the directors now recommend a final dividend of 4s. per share, free of income-tax, leaving a balance of £3,225 to be carried forward. The £110,000 new share capital, which was authorised at the extraordinary general meeting of the company held last November, was duly issued and distributed to the shareholders, thus increasing the issued capital to £330,000.

Puebla Tramway, Light and Power Co.—The directors' report, says a financial daily, shows a further improvement in the results for the year 1910, as compared with previous years, the net profits in Mexico having been £61,677, as against £48,677 for 1909, or an increase of 26 per cent.; and as against £27,354 for 1908, or an increase of 125 per cent. After meeting all expenses and bond and other interests there remains a balance of profit for the year of £5,441. The gross and net receipts of the light and power business continue to show satisfactory increases, and with the restoration of peace and an improvement in the condition of the cotton industry, the results of this section should continue to actively expand. The tramway receipts have, however, shown a decrease in 1910, which is attributable to abnormal trade conditions, and to an unusually heavy expenditure on maintenance. As indicated in the report for 1909, the growing demands of the City of Puebla, the absorption of the company's present available supply of power, and the necessity under the company's concessions of providing 16,500 H.P. within the city boundaries by 1913, have rendered it imperative for the directors to take steps to provide funds for the development of the Tuxpango Falls belonging to the company. For the purpose of financing this development it is proposed to take power to create an issue of $3,000,000 5 per cent. prior lien bonds, with the right to increase when required to an amount not exceeding $6,000,000 ranking *pari passu*.

Egypt.—The balance-sheet of the Compagnie Egyptienne Thomson-Houston, of Brussels, for the last financial year shows a profit of £6,052.

Madras Electric Supply Corporation, Ltd.

THE directors' report for the year ended December 31st, 1910, the first complete year of working since the opening of the generating station, states that the number of units of electrical energy sold was 1,882,787, compared with 267,568 units sold in 1909. The following figures show the progress of the company :—

Year.	Consumers.	Equivalent connections in 8-c.p. lamps.	Units sold.	Gross revenue.
1909	355	29,296	267,568	£5,057
1910	719	75,329	1,882,787	£17,454

During the past year 2,611,061 units were generated and distributed at an average cost of 1·08d. per unit. The board consider this satisfactory. Applications from new consumers for current for power and lighting continue to be received in satisfactory numbers. There are still some matters of difference between the company and the contractors, which have been referred to arbitration in accordance with the terms of the contract. The board have appointed Messrs. Merz & McLellan to be the consulting engineers to the company. Mr. A. M. Quill has been elected a director of the company in place of Sir Ralph Moor, deceased.

Total units generated	2,611,061
Public lamps	2,733
By special contract	1,158,743
To consumers by meter for lighting	703,305
To consumers by meter for power	18,006
Total sold	1,882,787
Used on works	166,749
Not accounted for	561,525
Accounted for	2,049,536
KW. connected for public lamps	16
Total maximum supply demanded, KW.	2,288

Continental Electrical Enterprises Co.

THE Continentale Gesellschaft für Elektrische Unternehmungen, of Nuremberg, which owns, manages, or is otherwise interested in, various electric railways, tramways, electricity works, &c., is best known in recent years from the circumstance that the company has endeavoured to introduce, although unsuccessfully so far, the suspended electric railway system in Berlin, where a short trial section was erected two or three years ago. According to the directors' report for 1910-11, most of the undertakings with which the company is concerned, were more remunerative than in the preceding year. The following figures are extracted from the accounts for the two years :—

	1910-11.	1909-10.
Preference capital	£1,556,000	£1,556,000
Ordinary capital	44,000	44,000
Bond capital	408,000	420,000
Gross profits	126,000	134,000
Net profits and balance forward	80,700	80,200
Dividend on preference capital, per cent.	4½	4½

It will be seen that most of the capital is represented by preference shares. This is explained by the fact that in a re-arrangement of the capital a few years ago the ordinary shares of consenting shareholders were converted into preference shares, the dissentient proprietors only forming £44,000 of the total share capital, and having so far received no dividends. As to the financial results of the various undertakings, the report states that the receipts of the Barmen-Elberfeld-Vohwinkel suspended railway, the system used on which it is desired to introduce in Berlin, increased from £70,000 in 1909-10 to £76,000 in 1910-11, and the surplus rose from £31,000 to £34,000 in the two years respectively. Of the French companies the Société Industrielle d'Energie Electrique, of Paris, had advanced its rate of dividend from 3 per cent. in 1909, to 4 per cent. in 1910, the Société Continentale de Traction et d'Eclairage par l'Electricité (Libau), of Paris, had also raised the rate from 3 to 4 per cent., whilst the Compagnie du Chemin de Fer sur route de Paris a'Arpajon had again distributed 4½ per cent. The report also gives particulars of other investments, and the undertakings under the company's control—the Barmen suspended railway and the works at Berchtesgaden, Gunzburg, Jassy and Muhlhausen, in Thuringia—are valued in the balance-sheet at £1,083,000.

It was mentioned at the recent general meeting that the new financial year would presumably also yield favourable results, as efforts were being made to equalise the higher wages paid by effecting economies in the working of the individual undertakings. The company had now also devoted its attention to the question of overland central stations, and was participating in their erection in various localities.

Victoria Falls Debentures.—It is reported from Berlin that the recent offer of debentures in the Victoria Falls and Transvaal Power Co. met with considerable success, and that it would be difficult for the issuing institutions to proceed with the allotments, especially as 26 places of subscription had to be considered. The 5 per cent. loan, which is for £1,300,000, resulted in the receipt of subscriptions for about £12,000,000, on which an embargo against transfers within a specified time was imposed, and only a small percentage can therefore be allowed on these applications, whilst other applications cannot be considered. A small portion of the loan is being reserved for the purpose of obtaining a quotation on the Exchange.

Hankow Light and Power Co., Ltd.

THE fifth annual meeting was held on Wednesday, last week, at the offices, 21, Ironmonger Lane, E.C. A representative of the ELECTRICAL REVIEW, who attended to report the proceedings, was informed that the meeting was private.

The directors' report stated that there had not been any change in the issued share capital during the year ended March 31st, 1911. In August, 1910, the directors authorised an issue of £12,000 of 7½ per cent. first mortgage debentures at 95, constituting a first charge on the company's assets, and £10,800 of debentures were applied for, allotted and paid up in full. The trust deed for the debentures provides that the company will redeem the debentures by annual instalments of not less than 10 per cent. The proceeds of the above issue have been applied in repaying the mortgages on the company's property, discharging the amount due to the estate of Poole, Lauder and Co. and other creditors, and providing for the cost of additional plant. In March last the directors accepted tenders for a 300-KW. plant, which is now practically finished, and will, it is expected, be shipped to Hankow in July and installed at the company's power station in time for the winter service. The lighting franchises from the English, French and Russian Concessions have now been formally assigned to this company. A new system of public lighting has been installed in the Concessions which is giving every satisfaction. There has been a steady increase in the private lighting and power department in the number of consumers of current for lighting purposes during the past year. The receipts for the year, as compared with the period for the six months ending March 31st, 1910, are as follows :—

	Year ending March 31st, 1911.	Six months ending March 31st, 1910.
Private lighting	£6,770	£3,678
Public lighting	1,825	832
Power	59	35
Meter rents	278	118
Installation and repairs	49	Nil
	£8,981	£4,663

The figures for the six months ending March 31st, 1910, cover the winter months, when, of course, the current consumed is much larger. The working expenses were 50·89 per cent. of the total receipts, as against 56·64 per cent., showing a decrease of 5·75 per cent. No depreciation has been written off plant, machinery, &c., but the directors point out that, as the debentures will be redeemed by 10 equal annual instalments, and it is their intention to charge such instalments against profits, this method of redemption will consequently create a reserve fund, which will be utilised as a provision to meet any depreciation of plant and machinery. The balance (credit) of the trading account for the year was £4,410, less discount and allowances £227, and adding transfer fees, &c., £45 —£4,229. After deducting interest, administration expenses, &c., there remains a balance of £1,433. The balance standing to the debit of revenue account at March 31st, 1910, was £3,947, so that there is now a debit balance of £2,514. The total capital expenditure during the year was £543. The Hon. A. S. Northcote and Mr. John May have been elected directors to fill the vacancies created by the retirement of Mr. R. C. Wyatt and Mr. John Macgregor, and the Hon. A. S. Northcote has been elected chairman. The directors record their appreciation of the services rendered by Mr. R. P. H. Davis as manager of the company in Hankow. They also congratulate the shareholders on the fact that, owing to the repayment of the mortgages and the discharge of the other liabilities of the company, coupled with the advantages accruing to the company as the result of Mr. E. R. Day's visit to Hankow, the company is now in an entirely satisfactory and independent position.

Chilian Electric Tramway and Light Co., Ltd.—The directors report that the result of the operations for the past year, after deducting interest and redemption of debentures, London office and other charges, shows a balance to credit of profit and loss account of £106,564, to which must be added the sum brought forward, £8,988, making a total net balance of £115,553. From this amount, says the *Financier*, £60,000 has been placed to renewals reserve account and £5,000 to insurance suspense account. After providing for the above there remains an available balance of £50,553, out of which a dividend of 6 per cent. on the preference shares, amounting to £39,000, has been declared, leaving a balance of £11,553 to be carried forward. In the year under review the tramways carried 83,148,755 passengers, earning $7,308,957, as against 75,670,443 passengers, earning $6,436,720, in 1909. The receipts for light and power during 1910 amounted to $1,070,272, and the total working expenditure amounted to $2,438,005, leaving a net profit of $1,632,267, against the net profit earned in the previous year of $1,224,764. The operation of the tramways shows a very satisfactory increase over the figures of the previous year.

National Telephone Co., Ltd.—The directors, subject to final audit, recommend the following dividends for the half-year ending June 30th, 1911, after payment of the dividends on the preference shares :—At the rate of 6 per cent. per annum on the preferred stock. At the rate of 6 per cent. per annum on the deferred stock, less income-tax in all cases, carrying £200,000 to reserve, and about £18,000 forward. The transfer books will be closed from July 14th to 27th, both days inclusive, and the dividend warrants will be posted on the latter date.

Japan.—The balance-sheet of the Tokio Electric Light Co. for the last financial year shows a net profit of £159,984. A dividend at the rate of 11 per cent. is being declared.

MARKET QUOTATIONS.

Wednesday, July 5th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	,,	28/-	..
a ,, Sulphuric	,,	5/6	..
a Ammoniac, Sal	,,	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a ,, ,, ...	,,	£30	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16	..
a Ferro-Silicon (50 %)	,,	£12 10	..
a Copper Sulphate	,,	£23	..
a Lead, Nitrate	,,	£24	..
a ,, White Sugar	,,	£22 15	..
a ,, Peroxide	,,	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, n casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide	,,	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70 %) ..	,,	£11	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a ,, Cyanide (basis 100 %) ..	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£70	..
b ,, Wire, in ton lots ..	,,	£102	..
b ,, Sheet, in ton lots ..	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis	per lb.	6¾d.	⅛d. inc.
c ,, Tube (brazed)	,,	8¼d.	..
c ,, ,, (solid drawn) ..	,,	7d.	..
c ,, Wire, basis	,,	6¾d.	..
c Copper Tubes (brazed)	,,	9¼d.	⅛d. inc.
c ,, ,, (solid drawn ..	,,	8¼d.	⅛d. inc.
g ,, Bars (best selected) ..	per ton	£71	..
g ,, Sheet	,,	£71	..
g ,, Rod	,,	£71	..
e ,, (Electrolytic) Bars ..	,,	£19	..
e ,, ,, Sheets ..	,,	£74	..
e ,, ,, Rod	,,	£69 10	..
e ,, ,, H.C. Wire	per lb.	7¼d.	..
f Ebonite Rod	,,	5/3	..
f ,, Sheet	,,	4/9	..
g German Silver Wire	,,	1/11	..
h Gutta-percha, fine	,,	8/6	..
h India-rubber, Para fine	,,	4/2	1d. inc.
l Iron Pig (Cleveland warrants) ..	per ton	46/3	6d. dec.
l ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Ingot	,,	£13 10 to £13 15	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 5 to £8 7 6	5/- dec.
d Mica (in original cases) small ..	per lb.	6d. to 2s.	..
d ,, ,, medium	,,	2/6 to 4/-	..
d ,, ,, large ..	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	172/6	..
e Silicium Bronze Wire	per lb.	8½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£192 to £193	£3 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/5	..
p White Anti-friction Metals ..	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£29 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

No sooner does the Stock Exchange get over one mal-influence than another comes along to take its place, and to be, if anything, rather more depressing than its predecessor. It would be as easy as it would be wearisome to reiterate the various causes which have militated against Stock Exchange investment and speculation during the past six or eight weeks. Suffice it to say that the latest of all, viz., the Moroccan trouble, assumed a gravity more portentous than most of the adverse influences which had gone before, and although the critical time is supposed to be over, the aftermath of the nervousness still remains.

In the circumstances, it is not to be supposed that this week's story in any of the markets will read satisfactorily from the point of view of holders of shares. There has been a very general drop round the markets, and confidence has received a fresh shock which acts as a preventive, even where it has no more active effects. The considerable gamble in Marconi shares goes on merrily, and after touching 49s. 6d., the shares fell back to 44s., from which they recovered this (Tuesday) afternoon, to 45s. 4½d.

So far as the Coronation traffics are concerned, it may be safely said that their influence is practically *nil*. The Underground Lines have done well, but this did not stop a fall of 5 points in Central London Deferred, following upon the drop of 2 last week. The price has gone down to 56 upon a small amount of stock being forced upon a narrow market, and the Ordinary declined to 71 in sympathy. On the other hand, Metropolitan Consolidated, after dipping to 47, has firmed up again, and Districts are quietly steady. A number of issues in this market, as in the other departments, were quoted *ex* dividend on June 30th and July 1st. At present, we have not detected an example of that stock which, according to the Stock Exchange jest, only changes when it is marked *ex* dividend, and therefore automatically becomes reduced to nothing in course of time.

Electricity Supply shares are a firm market, and there are improvements in St. James' Ordinary, Charing Cross Preference, and Westminster Ordinary. The Coronation celebrations have had the effect of diverting a few inquiries to this section, and, although not much business has resulted, it is at least something for a little interest to be aroused in the shares. For those who are seeking an investment in electricity supply shares, we would suggest that the market is likely to be quiescent for, at any rate, a few months. The summer is generally a poor time for illumination shares, and it would seem that the present year is not likely to prove any exception to the general rule. But for those who consider that the market has a chance of improvement in the autumn, we would indicate Metropolitans, County of London, and Westminsters, as being three of the best examples to be found in this list. There is a tip to buy London Electric shares, they being valued on an apparently conservative basis. It must be remembered, however, that the nominal value of the shares is £3, and that the company is paying small dividends. The contract with the Brighton line is, of course, a very useful factor, but we should prefer either of the three already mentioned for investment purposes.

The Notting Hill Company is rearranging its capital account in order to get rid of the founders' shares, and, in consequence, the official quotation has been withdrawn from the Stock Exchange list. In exchange for the founders', new Deferred are being given, and the price of these 1s. shares is about 30s. It seems rather an odd idea to eliminate founders' shares by the issue of Deferred shares, which carry rights somewhat similar to those which are being superseded, and the scheme has not been altogether favourably received in the market. The newly-created Cumulative Preference are nominally 11 to 12, and the non-Cumulative 10 to 11, both being £10 fully paid. No active market, however, has yet been made in either of these classes.

The feature in the Foreign and Colonial Supply department is the continued strength of Montreal capital stock, which has risen a further 2 points after its big rise of the past three weeks. The improvement of 5 points in Shawinigan capital stock has been followed by the suggestion that there may be an amalgamation scheme on foot. Northern Light and Power bonds are flatter than ever. Mexico Tramways are 3 points lower and the bonds are ¼ better, while Mexican Light and Power bonds are also slightly higher.

In the Telegraph market, the principal excitement, as already noticed, is concerned with Marconi shares. It would appear as though some of the big sellers had been caught badly short of the shares, and, being found out, they were made to pay a pretty stiff penalty for their action. At the time of writing, the company's report is not out, but it is expected at any minute. Anglo-American Telegraph and American Telephone and Telegraph stocks have both given way, the latter to the extent of 10 points. The movement in the former was due to the statement of the chairman at the Globe Telegraph and Trust meeting, that, so far as he knew, there was not even yet an agreement between these two companies. Considering the time that the matter has been in suspense, it would seem that the shareholders are well within their rights in asking that the business should be brought to a head and definitely settled. American Telephone and Telegraph is *ex* 7 points in respect of the rights to the new stock, and 2 for the dividend, so the actual decline is a trifle. The Eastern group is quiet, and, except for a fall of ¼ in Eastern Extensions, there is no movement worth mentioning. West India and Panama Preferences are a shade easier, and Western Telegraphs lost ¼.

Further excitement was provided by very sharp fluctuations in National Telephone Deferred. The price went down with a rush on the announcement that the company had failed in its appeal to the Courts against the Post Office. Upon this becoming known, there was a slump from 121 to 113, but a subsequent recovery to 118 occurred on buyers stepping in who had been watching for an opportunity to pick up the stock if there should be a fall of this description. The Third Preference have been involved in that movement, but the Senior Preferences did not move.

Messrs. Speyer Brothers are offering 2½ million pounds 4 per cent. rent charge stock at par in the Metropolitan District and London Electric Railways Joint Power House. The security is amply covered.

In the Manufacturing group the changes which have occurred are in nearly every case the result of *ex*-dividend markings. There are, however, falls of ¼ in Edison & Swan shares, and of $\frac{1}{16}$ in Electric Constructions, the latter wiping out the improvement of last week. It may be explained in this connection that where a stock or share is marked *ex* dividend in the price lists over-leaf, and the fall in the price merely reflects the amount deducted, no alteration is notified in the column recording rises and falls. Although nominally the security is quoted lower, actually there is no real change in the position, and it seems inappropriate to refer to a stock having fallen, say, two or three points when the change is simply due to the fact of the quotation being made *ex* dividend at the last Stock Exchange pay day.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 4th.	Rise + or Fall —	Present Yield p.c.
	*	1909.	1910.			£ s. d.
Bournemouth & Poole, Ord.	10	5⅛	5½	8 — 9	..	6 2 3
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10⅛ — 10⅜	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	100 —102 xd	..	4 8 3
Brompton & Kensington, Ord.	5	10	10	8 — 8⅜	..	5 17 8
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	3⅞ — 4⅛	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5⅛	+ ⅛	4 7 10
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4½ xd	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	+1	4 1 8
Chelsea, Ord.	5	4⅛	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	98 —100 xd	..	4 10 0
City of London, Ord.	10	7	7	11⅜ — 12½	..	5 14 3
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 10 0
Do. 5 % Deb.	Stock	5	5	119 —123 xd	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	99 —102 xd	..	4 8 3
County of Durham, 5 % First Mort. Deb.	Stock	5	5	89½ — 91½ xd	..	5 9 3
County of London, Ord.	10	5	5	7⅞ — 8⅛	..	6 3 1
Do. 6 % Pref.	10	6	6	11 — 11⅞	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	110 —112 xd	+3⅛	4 0 4
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2⅛ — 3	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	5⅜	6	4⅛ — 4⅝	..	6 9 9
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	97 —100	..	4 10 0
Hove	5	8½	9½	6¾ — 7½	..	6 11 0

NAME.	Stock or Share.	Dividends for		Closing Quotations July 4th.	Rise + or Fall —	Present Yield p.c.
	*	1909.	1910.			£ s. d.
Kensington & Knightsbridge, Ord	5	8	9	7 — 7½	..	6 2 0
Do. 4 % Deb.	Stock	4	4	98 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2	1⅝ — 2⅛	..	2 16 5
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 17 1
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3½ — 4	— ⅛	6 5 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜ xd	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —103 xd	..	4 7 5
Do. 3½ % Mort. Deb.	Stock	3½	3½	84½ — 87½ xd	..	4 0 0
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96 — 98 xd	..	4 11 10
Newcastle-on-Tyne	5	4	4	3⅛ — 4	..	5 0 0
Do. 5 % Pref., Non. Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	97 — 99 xd	..	5 1 0
Notting Hill	10	7½	8	.. — ..	..	6 5 6
Oxford	5	7	7½	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	9 — 9½	+ ⅛	5 5 3
Do. 7 % Pref.	5	7	7	6⅞ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84 — 86½ xd	..	4 0 11
Smithfield Markets, Ord.	5	Nil	Nil	1⅛ — 1⅜	..	Nil
South London, Ord.	4	5	5	2⅛ — 3 1/16	..	6 5 0
Do. 5 % First Mort. Deb.	100	5	5	98½ —101½ xd	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1⅛	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	3½	¾ — 1	..	18 15 0
Do. 5 % Cum. Pref.	5	5	3½	2⅜ — 3	..	6 5 5
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord.	5	10	10	7⅞ — 8⅜	+ ⅛	5 19 5
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅛ xd	+ ⅛	4 8 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 4 4
Calcutta, Ord.	5	8	8½	6⅜ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅜ — 5⅛	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	94½ — 96½	+ ½	5 3 8
Canadian Gen. El. Com.	$100	6	6	108 —111	..	5 10 1
Do. 7 % Pref.	$100	7	7	121 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	..	6	1/16 — 1/8	..	6 8 0
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½ xd	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	83 — 85	..	5 17 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 1/8	..	.. ..
Do. 6 % Pref.	1	6	6	13/16 — 7/8	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104 xd	+1	4 16 2
Madras, Ord.	5	Nil	Nil	2⅜ — 3⅛	..	.. ..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	+1	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86½ — 87½ xd	+ ½	5 14 3
Mexican Lt. & Power, Common	$100	4	4†	82½ — 84½	..	4 14 8
Do. 7 % Cum. Pref.	$100	7	7	106 —108	..	6 9 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94½ — 95½	+ ½	5 5 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	90 — 92	+ ½	5 8 8
Montreal, Lt., H. and Power	$100	..	8	173 —177	+2	4 10 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	52 — 54	—7	9 5 2
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½ —103½ xd	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5	5	120 —123	+5	4 1 4
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109 xd	+ ½	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91½ — 99½ xd	+1	5 6 11
Victoria Falls Power, Pref.	1	Nil	Nil	1/16 — 1 xd	..	.. ..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108 —110	..	5 9 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜ — 7¾	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	98 —100 xd	..	5 0 0
American Telep. & Teleg., Cap.	$100	8	8	143 —145	—1	5 10 4
Do. Collat. Trust	$1000	4	4	94 — 96 xd	..	4 3 4
Anglo-American Telegraph	Stock	3⅜	3⅜	69 — 71	..	5 5 3
Do. 6 % Pref.	Do.	6	6	113⅜ —114⅜	+ ⅜	5 4 7
Do. Def.	Do.	25/-	30/-	26⅛ — 26⅜	— ⅛	5 13 2
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	6†	7 — 7⅛	— 1/16	5 10 4
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	87½ — 89½ xd	+1	4 9 5
Cuba Telegraph	10	6	6	10 — 10⅜	..	5 11 7
Do. 10 % Pref.	10	10	10	17⅜ — 18⅛	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3⅞ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅜ — 8⅞	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	99 —101 xd	..	4 9 1
Direct United States Cable	10	4	5	7⅜ — 7½	— ⅛	6 7 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100 xd	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	136½ —139½	..	5 0 4
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	101 —103	..	3 17 8
Eastern Extension	10	7	7	13⅛ — 13⅜	— ⅛	5 2 9
Do. 4 % Deb.	Stock	4	4	101 —103	..	3 17 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½ —101½	..	3 18 10
Globe Telegraph and Trust	10	5⅞	5⅞	10⅞ — 11⅜ xd	..	5 3 3
Do. 6 % Pref.	10	6	6	13 — 13½ xd	..	4 8 11
Great Northern Telegraph	10	18	18	31⅛ — 32½	— ¼	5 11 7
Indo-European Telegraph	25	13	13	56¾ — 58½	..	5 11 1
Mackay Companies Common	$100	4½	5	92 — 94	..	5 6 5
Do. 4 % Cum. Pref.	$100	4	4	75 — 77	..	5 3 11
Marconi's Wireless Telegraph	1	Nil	Nil	2⅜ — 2⅝	+ 3/16	Nil.
Monte Video Telephone, Ord.	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	¾ — ⅞	..	5 10 4
National Telephone, Pref.	Stock	6	6	104½ —105½	+ ½	5 13 9
Do. Def.	Do.	6	6	116 —120	—8½	5 0 0
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜	..	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅜ — 5⅝	— 1/16	4 13 0
Do. 3½ % Deb.	Stock	3½	3½	98 —100 xd	..	3 10 0
Do. 4 % Deb.	Do	4	4	98 —100 xd	+ ½	4 0 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	101 —102	+ ½	4 8 3
Oriental Telep. and Elec.	1	8	6†	1⅞ — 1 11/16	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅝ — 1⅞	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86 — 88 xd	+ ½	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99 —101 xd	+ ½	3 19 3
Reuter's	8	5	5	8⅝ — 9½ xd	+ 3/16	4 7 9
Submarine Cables Trust	Cert.	6	6	131 —134	..	4 8 11
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	100 —102	..	4 8 3
United River Plate Telephone	5	8	6†	7⅜ — 7 13/16	..	5 2 5
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝ xd	..	4 9 11
West Coast of America	2½	2½	2½	1⅜ — 1⅝	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	97½ — 99½ xd	..	4 0 5
West India and Panama Teleg.	10	Nil	2	22⅜ — 23⅜	..	7 12 5
Do. 6 % Cum. 1st Pref.	10	6	6	10⅜ — 10⅝	— ⅛	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	100 —102 xd	+ ½	4 18 0
Western Telegraph, Ltd.	10	7	7	13⅛ — 13⅜	— ⅛	5 1 10
Do. 4 % Deb.	Stock	4	4	99 —101 xd	..	3 19 3
Western Union Tel., 4 % Bnds. A	$1000	4	4	105 —108	..	3 14 1
Do. 4½ % Fdg. Bonds	$1000	4½	4½	99½ —102½	..	4 7 10

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations July 4th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛ — ⅜		Nil
Do. 5 % Pref.	1	5	5	⅜ — ½xd	+ 1/16	6 18 4
Do. 4½ % Deb.	100	4½	4½	79 — 83		5 8 5
Brit. Elec. Trac., Ord.	10	Nil	Nil	1 — 1⅛	+ 1/16	Nil
Do. 6 % Pref.	10	3	3	3½ — 4¼xd		7 1 2
Do. 5 % Deb.	100	5	5	96 — 99		5 1 0
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 81		5 11 1
Central London Railway, Ord.	100	3	3	70 — 72	+ ½	4 3 4
Do. Pref.	100	4	4	87 — 89		4 9 11
Do. Def.	100	2	2	55 — 57	—5	3 10 2
Do. 4 % Deb.	100	4	4	104 —106		3 15 6
City & South London, Ord.	100	1½	1½	31½— 32½		4 12 4
Do. 5 % Pref., 1891	100	5	5	109 —111		4 10 1
Do. Do. 1896	100	5	5	105 —108		4 12 7
Do. Do. 1901	100	5	5	104 —107		4 13 6
Do. Do. 1908	100	5	5	103 —106		4 14 4
Do. 4 % Deb.	100	4	4	102 —104		3 16 7
Dublin United Trams, 6 % Pref.	10	6	6	12½ — 13½		4 10 7
Great Northern & City, Pref. Ord	10	Nil	Nil	½ — 1½		Nil
Hastings Trams, 6 % Pref.	5	Nil	Nil	1½ — 2		Nil
Do. 4½ % Deb.	100	4½	4½	75 — 80		5 12 6
Isle of Thanet Trams, 5 % Pref.	5	1½	2½	2½ — 2⅝		4 10 11
Do. 4 % Deb.	100	4	4	77 — 82 xd		4 17 7
Lancashire United, 5 % Deb.	100	5	5	79 — 82 xd		6 1 11
London Elec. Railw'ys, 4 % Deb.	100	4	4	96 — 98 xd		4 1 8
London United Trams, 5 % Pref.	10	Nil	Nil	3¾ — 4⅛		Nil
Do. 4 % Deb.	100	4	4	75 — 78 xd		5 2 7

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations July 4th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	100	1	1⅛	47½— 47⅞	+ ¼	2 17 7
Do. Surplus Lands	100	2½	2½	68 — 70		3 18 7
Do. 3½ % Deb.	100	3½	3½	93 — 95		3 13 8
Do. 3½ % Pref.	100	3½	3½	90 — 92		3 16 1
Do. 3½ % Con. Pref.	100	3½	3½	89 — 91		3 16 11
Metropolitan District Ord.	100	Nil	Nil	28½ — 29		Nil
Do. 6 % Deb.	100	6	6	145 —147 xd		4 1 8
Do. 4 % Deb.	100	4	4	96 — 98 xd		4 1 8
Do. 4 % Prior Lien	100	4	4	101 —103	—1	3 17 8
Do. 4½ % First Pref.	100		3½	88 — 90		3 12 3
Do. 3½ % Gtd.	100	3½	3½	76 — 78		4 9 9
Metropolitan Elec. Trams, Ord.	1	5	5½	33/32 — 1 1/32		5 6 8
Do. Def.	1	Nil	Nil	1/32 — 1/16		Nil
Do. 5 % Pref.	1	5	5	33/32 — 1 1/32		4 17 0
Do. 4½ % Deb.	100	4½	4½	100 —102 xd		4 8 3
Do. 5 % Deb.	100	5	5	102 —104		4 16 2
Potteries, Ord.	1	2	..	1/32 — 3/32		..
Do. 5 % Pref.	1	5	5	1¼ — 1⅜	— 1/16	7 13 6
Do. 4½ % Deb.	100	4½	4½	88 — 91		5 18 11
South Metro. Trams, 6 % Pref.	1	3	..	1/32 — 1/32		..
Do. 4 % Deb.	100	4	4	73 — 78 xd		5 15 5
Underground Elec. Railways 5 % Prior Lien	..	5	5	100½—101½	+ ½	4 18 6
Do. 4½ % Bonds	100	4½	4½	99 —101	—1	4 9 1
Do. 6 % Income	100	Nil	10/-	65 — 67	—3	0 14 11
Do. Power House Debs.	100	..	4	101 —103	+1	3 17 8
Yorkshire (West Riding), Ord.	5	Nil	Nil	1/32 — 3/32		Nil
Do. 6 % Pref.	5	Nil	Nil	2⅛ — 2⅜		..
Do. 4½ % Deb.	100	4½	4½	89 — 85 xd		5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5⅛ — 5⅜	— 1/16	4 14 6
Do. 2nd Pref.	5	5	5	4⅛ — 5⅛	— 1/16	4 18 9
Do. 4 % Deb.	100	4	4	94 — 96		4 3 4
Do. 4½ % Deb.	100	4½	4½	99½—101½		4 8 8
Do. 5 % Deb.	100	5	5	100 —102	— ½	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	102 —104 xd		4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅞— 11⅜		5 5 6
Do. 4½ % Deb.	100	4½	4½	96 — 98 xd		4 11 10
Do. 5 % 2nd Deb.	100	5	5	99½— 99½ xd		5 1 6
Brisbane Trams Inyt., Ord.	5	8½	8½	6⅝ — 6⅞		6 5 11
Do. 5 % Pref.	5	5	5	5 — 5⅛		4 19 0
Do. 4½ % Deb.	100	4½	4½	99 —102 xd		4 8 3
B. Columbia Elec. Rly., Def.	100	8	8	146 —150		5 6 8
Do. Pref. Ord.	100	6	6	128½—132½		4 10 7
Do. 5 % Pref.	100	5	5	111 —113		4 8 6
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103		4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —105		4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	101½—102½		4 7 0
Calcutta Trams, Ord.	5	4½	5	5½ — 6⅛		4 0 0
Do. 5 % Pref.	5	5	5	5 — 5⅛	— 1/16	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103 xd		4 7 5
Cape Electric Trams	1	Nil	Nil	1/16 — 1/8		Nil
City Buenos Aires Trams (1904)	5	5	5	5⅛ — 5⅜		4 5 1
Do. 4 % Deb.	100	5	5	94 — 97 xd		5 3 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 98		5 2 0
Havana Elec. Rly., 6 % Bonds	$1000	5	5	101 —103	+ ½	4 17 1
Kalgoorlie Elec. Trams	1	Nil	Nil	3/32 — 1/8		Nil
Do. 5 % A Deb.	100	5	5	91½ — 94½		5 5 10
Do. 6 % B Deb.	100	6	5	66 — 67		7 9 3

La Plata Elec. Trms, Prf, 17/6 pd.	1	6	6	⅜ — ⅝	— 1/16	8 0 0
Lisbon Elec. Trams, Ord.	1	6	6	1 — 1¼		4 16 0
Do. 6 % Pref.	1	6	6	1 — 1¼		4 16 0
Do. 5 % Deb.	100	5	5	97 —101 xd	+ ½	4 19 0
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98 xd	+ ½	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	90½— 93½ xd		5 6 11
Manila Elec. R. and Ltg., Bonds	$1000	5	5	99½—101½		4 18 6
Mexico Trams Com.	$100	6	7	121 —123	—3	5 13 10
Do. Gen. Con. 5 % Bonds		5	5	95 — 96	+ ½	5 4 2
Do. 6 % Bonds	100	6	6	97½— 99½ xd	+ ½	6 0 7
Para Elec. Rlys. & Lt., Ord.	5	..	10	7 — 7⅛	— ⅛	6 15 7
Do. 6 % Pref.	5	6	6	5½ — 5⅝		5 4 4
Do. 5 % 1st Deb.	100	5	5	99 —101		4 19 0
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1¼ — 1⅜		2 13 4
Do. 5 % 1st. Deb.	100	5	5	101½—103½ xd		4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅝ — 5⅞ xd		5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	97 —100 xd		4 10 0
Rio de Janeiro Trams	$100	2	5	113½—114½	—1½	4 7 4
Do. 1st Mort. 5 % Bonds		5	5	100½—101½ xd		4 18 9
Do. 5 % Mort. Bonds	100	5	5	95½ — 96½		5 3 8
Sao Paulo Tram, Lt. and P.	$100	10	10	181½—183½	—2½	5 9 0
Do. 5 % 1st Deb.	$500	5	5	102 —104		4 16 ..
Singapore Trams, 5 % Deb.	100	5	5	83 — 87		5 15 ..
Southern El. Tr. B.A., 5 % Deb.	..	5	5	98 —100		5 0 0
Un. Elec. Trams Monte Video	5	7	7	5⅞ — 6⅛ xd	+ ⅛	5 9 10
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛ xd		5 11 7
Do. 5 % 1st Deb.	100	5	5	102 —105		4 15 3
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	106 —109		4 3 4

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	6	⅛ — ⅜ xd	..	7 7 8
Do. 6 % Pref.	1	12	9	⅛ — ⅜ xd	..	6 17 2
Babcock & Wilcox	1	24	20†	5⅛ — 5⅜	..	4 5 4
Do. Pref.	1	6	6	1⅝ — 1¾	..	4 0 0
B.I. & Helsby Cables	5	10	10	6¾ — 7⅛	..	6 15 7
Do. Pref.	5	6	6	6 — 6⅛	..	4 12 4
Do. Deb.	100	4½	4½	100 —102 xd	..	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	1⅛ — 1⅜	..	Nil
Do. Deb.	100	4	4	59 — 62 xd	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	+1	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	3/32 — 1/8	..	Nil
Do. Pref.	1	Nil	Nil	14/6—15/6	..	Nil
Brush, Ord.	2	Nil	Nil	⅛ — ¼	..	Nil
Do. 7 % Pref.	2	Nil	Nil	⅛ — ¼	..	Nil
Do. 4½ % Deb.	100	4½	4½	59 — 64	..	7 0 8
Do. 4½ % Second Deb.	100	4½	4½	39 — 44 xd	..	10 4 6
Callender's Cable	5	15	10†	8⅜ — 9⅛	— ⅛	8 2 2
Do. Pref.	5	5	5	4⅞ — 5⅛ xd	+ ⅛	4 17 7
Do. Deb.	100	4½	4½	101 —103 xd	+2	4 7 5
Castner-Kellner	1	17½	7½†	8⅜ — 8½	..	5 1 6
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co.	9	Nil	Nil	⅛ — ¼	..	Nil
Do. Deb.	100	x5⅝	5	57½— 67⅝ xd	..	7 8 2

Dick, Kerr	1	5	6	12⅝— 13⅜	..	6 8 0
Do. Pref.	1	6	6	13⅜ — 14⅛	..	5 9 7
Do. Deb.	100	4½	4½	95 — 98 xd	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	Nil	⅜ — ½	— ⅛	Nil
Do. fully paid	5	Nil	Nil	1⅝ — 2⅜		Nil
Do. 4 % Deb.	100	x4	4	69 — 71 xd	+1	5 12 8
Do. 5 % Second Deb.	100	5	5	78 — 81		6 3 5
Electric Construction	2	Nil	Nil	⅛ — 3/16	— 1/16	Nil
Do. Pref.	2	7	7	1⅛ — 2		7 0 0
Greenwood & Batley, Pref.	10	7	7	10½ — 10⅞		6 10 3
Do. Deb.	100	5	5	102 —103½		4 16 7
General Electric, Pref.	10	5	5	8¼ — 9 xd		5 11 1
Do. Deb.	100	4	4	88 — 93		4 6 0
Henley's, Ord.	5	15	15	12½ — 12⅞		5 16 6
Do. Pref.	5	4½	4½	4⅞ — 5⅛		4 7 10
Do. Deb.	100	4½	4½	106 —108		4 3 4
India-Rubber, G. & T.	10	10	10	11⅛ — 13⅛		7 8
Do. Pref.	10	5	5	10⅛ — 10½ xd		4 15 3
Telegraph Construction	12	17½	20	36½ — 38½		6 5 0
Do. Deb.	100	4	4	99 —101 xd	+1	3 19 3
Willans & Robinson	1	Nil	Nil	⅛ — ¼		Nil
Do. Pref.	5	5	Nil	1 — 1⅛		Nil
Do. Deb.	100	4	4	55 — 65		6 3 1

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 3 per cent., March 9th, 1911.

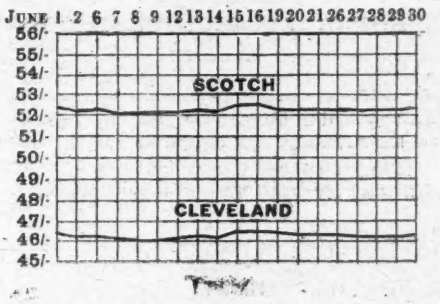
METAL MARKET.

Fluctuations in June.

SPELTER (G.O.B's.).

LEAD (ENGLISH).

IRON.



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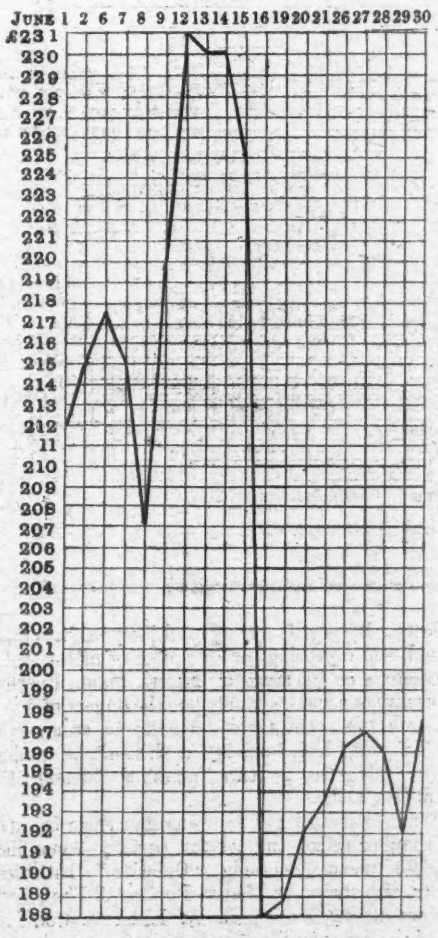
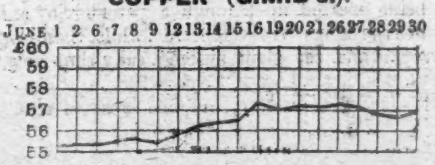


COPPER (G.M.B's.).



OLYMPIA ELECTRICAL EXHIBITION.

THE following is a list of the exhibitors who have down to date booked space at the Exhibition of September 23rd to October 21st. In publishing this list we also print for the information of our readers, in order to save disappointment later on, the following excerpt from Rule 5 of the Rules and Regulations:—

"Exhibitors, the nature of whose displays necessitates them showing goods of other manufacturers, agree not to advertise such makers' names either upon the article shown or upon their stands, unless such goods are manufactured by a fellow-exhibiting firm or are specified on the space contract. Any contravention of this Rule will render the offending exhibitor liable for any damage that the Committee or the management may incur."

Armorduct Manufacturing Co., Ltd.
Abbey Electric Co.
Aerators, Ltd.
Adams Manufacturing Co., Ltd.
Aster Engineering Co., Ltd.
Auto Recorder Co.
Alexander, Geo. H.
Allen & Simmonds, Ltd.
Brook, E., Ltd.
Brook, Hirst & Co., Ltd.
Berry, Skinner & Co.
Bruce Peebles & Co., Ltd.
British Vacuum Cleaner Co., Ltd.
Bastian Electric Heating Syndicate, Ltd.
Bastian Meter Co., Ltd.
British Thomson-Houston Co., Ltd.
Brush Electrical Engineering Co., Ltd.
Buckton, Joshua, & Co., Ltd.
Bat Meter Co., Ltd.
Barker, John, & Co., Ltd, (Kennedy Bending Machine).
Bennis, E., & Co., Ltd.
Benjamin Electric, Ltd.
Bonnella & Son, Ltd.
Braun & Co.
Brunner, Mond & Co., Ltd.
Bullers, Ltd.
Burton, C. W., Griffiths & Co.
British Metal Engraving Co., Ltd.
Bristol (The) Co.
British Aluminium Co., Ltd.
British Electric Transformer Co., Ltd.
Berry Construction Co., Ltd.
British Prometheus & Co., Ltd.
Bell, Heslop
Boosey, W. E., & Co. (The Trident Co.)
Churchill, Chas., & Co., Ltd.
Crypto Electrical Co.
Chamberlain & Hookham, Ltd.
Credenda Conduit Co.
Cateaux, J. L., & Co.
Coventry Chain Co. (1907), Ltd.
Consolidated Pneumatic Tool Co., Ltd.
Callender's Cable & Construction Co., Ltd.
Cassier, Louis, & Co., Ltd.
Concordia Electric Wire Co., Ltd.
Corona Lamp Works Co.
Dowsing Radiant Heat Co., Ltd.
Drake & Gorham, Ltd.
Dorman & Smith
Dussek Bitumen Co.
Dugdill, J., & Co.
ELECTRICAL REVIEW
Electricity
Electrical Times, Ltd.
Electrical Engineering
Electromotors, Ltd.
Electrical Press, Ltd.
Everett, Edgcumbe & Co., Ltd.
Electric Ordnance & Accessories Co., Ltd.
Ebonestos Manufacturing Co., Ltd.
Elliott Bros.
Electrician
Engineering Instruments, Ltd.
Electrical Apparatus, Ltd.
Escaré & Denelle, Ltd.
Eyre Smelting Co., Ltd.
Elandem Co.
Electrical Engineer, Ltd.
Emanuel, A., & Sons, Ltd.
Edison & Swan United Electric Light Co., Ltd.
Engineer, Ltd.
Eastman & Warne
Eastman & Son (Dyers and Cleaners), Ltd.
Evershed & Vignoles, Ltd.
Ferranti, Ltd.
Falk, Stadelmann & Co., Ltd.
Foster Engineering Co., Ltd.
Famous Diamond Steel Co.
Globe Electric Co., Ltd.
General Electric Co., Ltd.
Galsworthy, Ltd.
Geipel, W., & Co.
Goodchild, G. W., & Partner
Gambrell Bros.
Gent & Co., Ltd.
Hands, A. C.
Hopkinson, J., & Co., Ltd.
Hornsby, R., & Sons, Ltd.
Hervé, L.
Hoffmann Manufacturing Co., Ltd.
Henley's, W. T., Telegraph Works Co., Ltd.
Holophane, Ltd.
Hawkes, O. C., Ltd.
Holmquist Electric Co., Ltd.
Hart Manufacturing Co.
Hill, Sifken & Co.
Hardware Trade Journal, Ltd.
Imperial Lamp Works (Brimsdown) Ltd.
Imperial Electric Co.
Iron and Coal Trades Review
Isenthal & Co.
Imperial Lighting Co.
Ironmongers' Chronicle and Hardwareman.
Johnson & Phillips, Ltd.
Jandus Arc Lamp and Electric Co., Ltd.
Jacobs, W. & R.
Lundberg, A. P., & Sons
Lancashire Dynamo and Motor Co., Ltd.
Le Carbone
Lea Recorder Co.
Longstreth's Ltd.
Lucy, W., & Co., Ltd.
London Decorative Metal Works, Ltd.
Litho-ite, Ltd.
Linolite Co.
Laing, Wharton & Co., Ltd.
Leskole Co., Ltd.
Lanston-Monotype Corporation, Ltd.
Lister, R. A., & Co., Ltd.
Muirhead & Co., Ltd.
Major & Co., Ltd.
Morgan Crucible Co., Ltd.
Marryat & Place
Mawdsley's, Ltd.
Marconi's Wireless Telegraph Co., Ltd.
Metalite, Ltd.
Medway's Safety Lift Co.
Nalder Bros. & Thompson, Ltd.
Nalder Bros. & Co.
National Telewriter Co., Ltd.
Nicholson, W. T., & Clipper Co., Ltd.
Nelson Bros. (Bradford)
Oliver Arc Lamp, Ltd.
Ozonair, Ltd.
Pope's Electric Lamp Co., Ltd.
Paul, R. W.
Pinchin, Johnson & Co., Ltd.
Purcell & Nobbs
Phillips Commutator Grinder Co., Ltd.
Phœnix Dynamo Manufacturing Co., Ltd.
Parmiter, Hope & Sugden
Pooley & Austin
Proctor, James, Ltd.
Phillips, J. W. & C. J.
Parsons, C. A., & Co.
Post Office London Telephone Service
Pape, Richard, Ltd.
Pirelli, Ltd.
Post Office Telegraphs
Premier Electric Heaters, Ltd.
Reyrolle, A., & Co., Ltd.
Rhodes, J., & Sons, Ltd.
Ronald Manufacturing Co.
Rühl, O., Ltd.
Rapid Magnetting Machine Co., Ltd.
Renold, Hans, Ltd.
Reavell & Co., Ltd.
Sunderland Forge & Engineering Co., Ltd.
Sterling Telephone & Electric Co., Ltd.
Sun Electrical Co., Ltd.
Sunbeam Lamp Co., Ltd.
St. James' and Pall Mall Electric Light Co., Ltd.
Smith, J. Ciceri
Simmonds Bros., Ltd.
Schaffer & Budenberg, Ltd.
Spagnoletti, Ltd.
Siemens Bros. & Co., Ltd.
Silver Replating Powder Co.
Samuel Bros., Ltd.
Stern-Sonneborn Oil Co., Ltd.
Simplex Conduits, Ltd.
Stone, J. B., & Co.
Ship Carbons, Ltd.
Synchronome Co.
Slingsby, H. C.
Tucker, J. H., & Co.
Thomas, Bertram
Tella Camera Co.
Tackley, W. C., & Co.
Union Electric Co., Ltd.
Union Cable Co., Ltd.
Unbreakable Pulley and Mill Gearing Co., Ltd.
Venner & Co.
Vedovelli, Priestley & Co.
Vickers, Ltd.
Willcox, W. H., & Co., Ltd.
Watson, Duncan & Co.
Whipp & Bourne
Walker, Horrocks & Co., Ltd.
Waygood, R., & Co., Ltd.
Westinghouse Brake Co., Ltd.
West, Allen & Co., Ltd.
Westminster Engineering Co., Ltd.
Western Electric Co., Ltd.
Wiggin, H., & Co., Ltd.
Wallach Bros., Ltd.
Weil, L., & Reinhardt
Westinghouse Cooper Hewitt Co., Ltd.
Wright & Wood, Ltd.
Wandsworth Electrical Manufacturing Co., Ltd.
Wright, Alex., & Co., Ltd.

THE ELECTRO-METALS STEEL-REFINING FURNACE.

In recent years great advances have been made in the electric smelting of steel, and although most of the earlier work was done on the Continent, there are now several furnaces working successfully in England.

The latest type to be introduced into this country, and one that in several ways has undoubted advantages, is the Electro-Metals furnace. This furnace is of the arc type as opposed to the induction type, but it differs from other arc furnaces inasmuch as two-phase current is employed. The principle on which the furnace is based is that of having two electrodes entering through the roof, while the neutral return is a carbon electrode embedded in the bottom.

The current arcs from the top electrodes on to the slag and metal, and then passes through the metal and the refractory lining of magnesite or dolomite to the neutral electrode, either of these materials for lining when hot being a quite sufficiently good conductor.

A furnace of this type, in operation in Sheffield, consists of an iron tank, lined with refractory brickwork, and inside this the hearth is formed by ramming in either dolomite or magnesite. The carbon terminal, forming the neutral point, is held in an iron casting bolted to the bottom of the furnace, and the top of the carbon comes just flush with the brickwork lining, so that it does not project into and in any way weaken the lining of tamped dolomite.

The roof, which consists of an angle-iron framework carrying silica bricks, is removable, so that when the bricks become worn too thin for further work the roof is taken off and replaced by a new one. The whole operation of changing requires about 20 minutes.

There is a working door at each end, and another one at the tapping spout, and at the back are mounted the holders and regulators for the electrodes carrying the two phases. These holders are of quite a new type, and may be considered as one of the special features of the furnace.

The electrode is placed in position, and a set-pin is tightened up; this drives the copper plates carrying the cables tight against the electrode at the same time. As this arrangement is easily manipulated, it is possible always to keep the electrical contact at that part of the electrode where it enters the furnace. In this way the electrical losses in the electrodes are reduced to a minimum.

The whole furnace is mounted on curved rails, on which it is tilted.

The electrical plant consists of two single-phase transformers of 400 K.V.A. each, transforming from 2,000 to 50, 60, or 70 volts. These transformers were specially designed by the British Westinghouse Co., Ltd., for electric furnace work. The switchgear consists of one two-pole main oil switch in circuit with the H.T. mains.

There is an ammeter on each phase reading to 8,000 on the L.T. side, and one reading to 12,000 in circuit on the neutral; one voltmeter with three-way switch for reading the voltages of the A and B phases, and one power-factor meter.

The capacity of the furnace is only 2½-3 tons, and it will be seen that this particular furnace is overpowered, but this was done intentionally, as it is probable that the owner of the works will install a larger furnace at a later date.

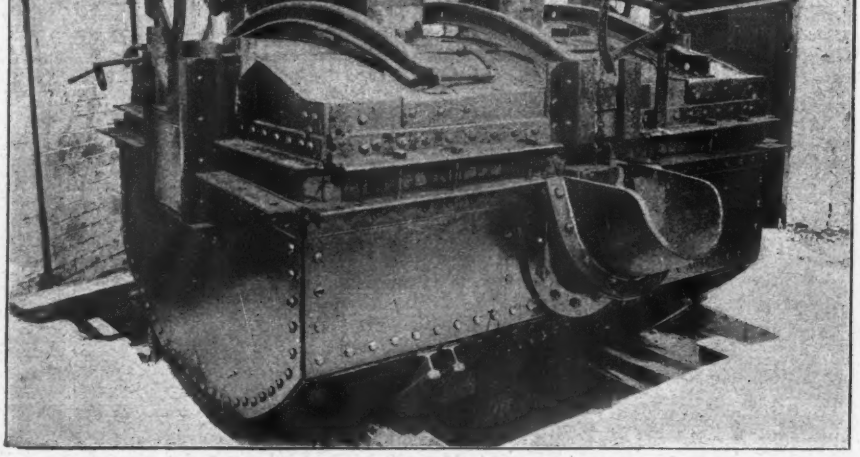
Compared with single-phase furnaces, the Electro-Metals system has the advantage of allowing the current to be taken direct from the mains of either a two or a three-phase supply, without the intervention of motor-generators, which, compared with transformers, are not only very inefficient, but are also costly in initial outlay and running costs.

Another advantage of the Electro-Metals arrangement is that during melting from the cold, the furnace runs very smoothly. It is stated that this feature is so marked that the Sheffield Corporation allows this furnace to be started on a cold charge during the peak load.

Apart, however, from the purely electrical aspect of the question, it has been found by experience that the two-phase arrangement with two electrodes at the top and one at the bottom has decided metallurgical advantages. One of the great troubles in arc furnaces has always been that the heating is extremely local, with the result that, although the current is raised to such an extent that the heat from the arc overheats and seriously damages the upper part of the furnace, there is very often cold unrefined metal lying in the bottom of the hearth. In the Electro-Metals furnace this difficulty has been quite overcome; the passage of the current through the dolomite lining keeps the bottom of the furnace well heated all over, and it does this with the loss of very little energy and without in the least weakening or breaking up the bottom. In addition to this thermal effect, it has been found that, unlike either a single-phase or a three-phase arrangement, the two-phase current causes both horizontal and vertical movements in the bath. These movements rapidly bring all parts of the metal under the influence of the arc and into contact with the refining slag. In this way the time and energy consumption for refining are much lowered, and at the same time local overheating of the furnace and lack of homogeneity in the metal are done away with.

This furnace has been installed at the Sheffield Annealing Works, Warren Street, Sheffield; large numbers of steel makers have already seen demonstration charges treated, and great satisfaction has been expressed at the results. Already some 80 charges have been put through, and it is possible to put through three charges a day.

The illustration shows the furnace in use; it is of the Grönwall type, and the same pattern is installed at Trollhättan, Söderfors, Domnarfvet and Arvika.



Electro-Metals Steel Furnace at Sheffield.

THE ROYAL AGRICULTURAL SHOW.

Although more electrical apparatus is shown at each Royal Show than appeared in the previous year, the increase is very slow when the advantages of electricity for the farmer and country estate owner are considered, and even supposing private generation to be impracticable, a large and increasing number of farms and estates are within reach of public supply mains.

The electric driving of farming machinery was very meagrely represented, and excepting for a number of motors belted to fodder machines on the stand of Messrs. Mann, Egerton and Co., the examples could be counted on the fingers of one hand. In fact, only two other motors were to be seen:—One by Messrs. Tangyes, Ltd., driving a three-throw pump, and the other belted to a straw press by Messrs. Ruston, Proctor & Co., Ltd.

The dynamos made a fair show, most of them being direct-coupled to oil or petrol engines for country house lighting. A complete plant, including "Chloride" batteries and accessories, was shown by Messrs. Boulton & Paul, Ltd., and two equipments by Messrs. R. A. Lister & Co., Ltd., the exhibit of the last-named firm being of particular interest. The installation was entirely automatic, the engine and dynamo being started up through a patent relay and auto-starter when the lamps were switched on, whilst these operations were reversed and the plant automatically shut down when no current was demanded. Of course these results cannot be achieved without a battery, but the latter is a very small

affair, consisting of ignition-type cells which are contained in a cabinet behind the switchboard.

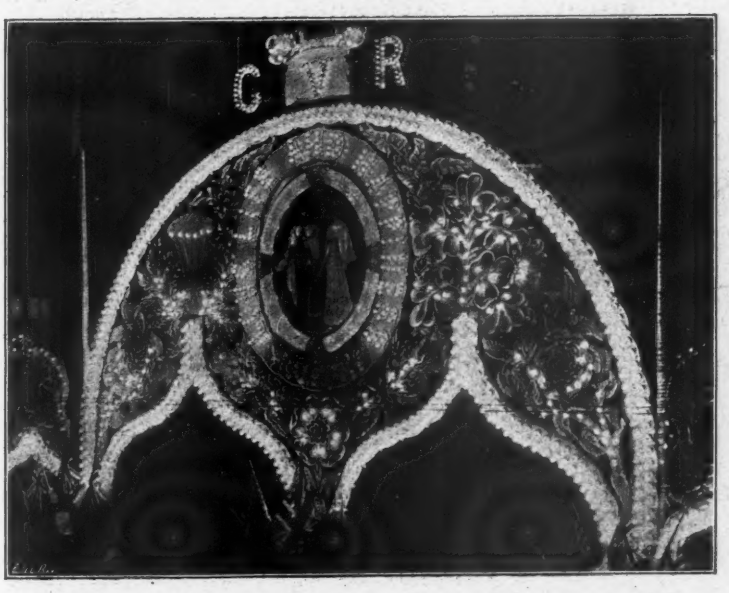
Two complete plants were shown by Messrs. Lister, together with a series of lamps to demonstrate the automatic operation. It should also be stated that similar arrangements are applied to installations consisting of two or more generating sets which are started up and shut down according to the demand for current.

These two plants were started and stopped by simply switching lights on and off for the benefit of our representative, and they fully substantiated the claims made for them. An important feature is the mounting of the entire equipment, excepting the switchboard and battery, upon a steel frame, the plants being delivered in this form and ready for work without any foundations.

An installation complete, excepting for the battery, was shown by Messrs. Collingham & Owen, the dynamo of 2½ KW. at 110 volts being direct coupled to a vertical oil engine.

Oil engines direct coupled to dynamos were shown by Messrs. Richard Hornsby & Sons, Ltd., and several other firms, whilst gas-driven generators were exhibited by Messrs. Tangyes, Ltd., and the National Gas Engine Co., Ltd.

Several very interesting oil engines were shown without dynamos, but which are particularly suitable for the economical generation of electricity. One of these, by Messrs. J. W. Brooke & Co., Ltd., was a new type 10-B.H.P.



Electric Arch at Burton-on-Trent.

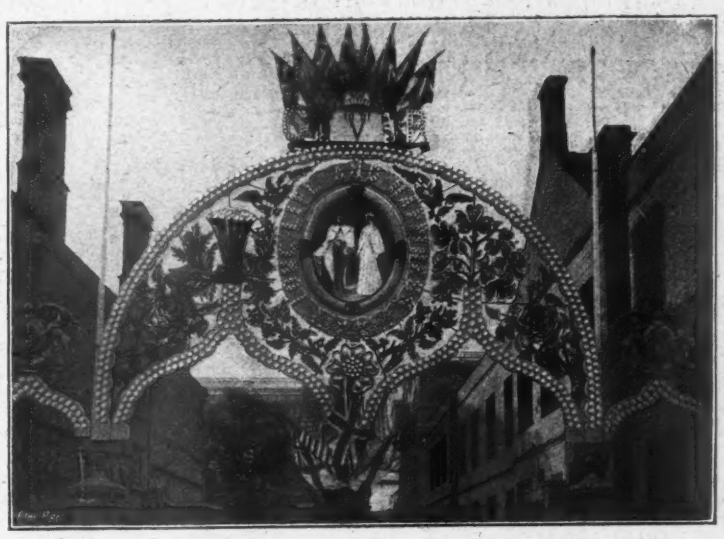
paraffin engine with hot bulb ignition. This engine has one cylinder of the four-cycle type with oil injection into the vaporiser by a governor controlled pump, hence air only is compressed. A lamp is required for a few minutes at starting, after which the ignition is automatic, no magneto or battery being needed.

(To be continued.)

India.—In view of the increase of electrical work, the East Indian Railway Co. has arranged for the provision of a separate office and workshop for the electrical department of the company, at the Carriage and Wagon Works, at Lillooah.

CORONATION ILLUMINATIONS AT BURTON-ON-TRENT.

Messrs. Bass & Co., of Burton-on-Trent, have always been noted for the beautiful decorations with which they adorn their offices in times of royal rejoicing, but during the Coronation they excelled all their previous decorations with a most beautiful display. Their premises naturally have a very wide frontage, and upon this designs were erected which were illuminated by about 4,000 lamps. The most prominent feature of the whole was an elaborate electric arch across the brewery entrance, between two sections of the premises.



Electric Arch at Burton-on-Trent.

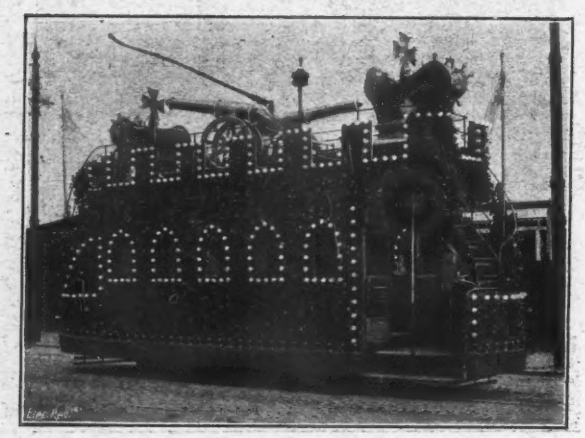
The arch shields, and stars, were illuminated with 8-C.P. lamps, and the foliage, which consisted of beautiful rose spray, millinery and flowers, was illuminated by about 1,000 miniature lamps. A number of photographs that are before us as we write, show how effective the display was by night. We reproduce views of the arch by day and by night. A well-known artist was commissioned to paint a large portrait of the King and Queen, and these were framed in crystals. The arch already mentioned weighed approximately 2 tons, the design being the national emblems, shamrock, rose and thistle, illuminated by suitably coloured lamps, the whole being surmounted by the Imperial crown, under which were the portraits of their Majesties. Large stars, coats of arms, lions' heads, flambeaux containing globes, all find a place in the design, and the whole of them were wreathed in roses. Some idea of the brilliancy can be obtained from the fact that each star contained about 270 8-C.P. lamps. The whole design of the floral spray in colour represented ropes of pearls, rubies, and turquoises, and crowds of people went into the town from the surrounding country to view what was considered to be one of the most beautiful displays of electrical illuminations in the country.

The whole of the design was the work of Mr. W. B. Ollis, the chief engineer of Messrs. Bass & Co., and the illuminations were supplied from the Corporation mains

Tramcar Conductor's Experience.—An unusual accident happened at Carlisle on June 21st. While a tramcar conductor was endeavouring to adjust a trolley upon a wire at the Warwick Road terminus as the car was moving, the rope caught his thumb, fastening it in a noose. He was slung up 10 ft. from the ground, unable to help himself. The driver of a motor-car seeing the man's plight ran his car underneath the conductor, and an occupant of the car standing up was able to get hold of the man and help him to get his thumb free from the rope. Apart from the shock the conductor suffered, he was uninjured by the accident.

ILLUMINATED TRAMCARS AT GLASGOW.

CELEBRATING an important event, by running a number of gaily decorated and brightly illuminated cars, is not a new departure for the Glasgow municipality. On quite a recent occasion the fiftieth anniversary of the introduction of Loch Katrine water to the city was commemorated in this fashion. A very appropriate display has just been made in celebration of the Coronation, and the effect was most successful. Running the cars on a series of nights over an extended area with a big population, made variety of effect a desideratum. There were a number of such cars, and in design and



GLASGOW CORONATION CAR—IVY-COVERED CASTLE.

colour each car was totally different. No. 1 was military in character and colour, with flags and shields, red and white predominating. The body of the car was divided into three tiers of panels, the lowest being filled with shields, the uppermost draped, the middle having specially prepared transparencies of the King and Queen flanked by monograms and the date of the Coronation. Immediately over the King and Queen there was placed a gilded crown with varied coloured lights, and appropriate drapery. Larger crowns surmounted the top; at the sides of the car were groups of flags, while festoons of lights connected these points forming an illuminated diamond.

If No. 1 depended on ordinary decorative colours for effect, No. 2 might be described as æsthetically delicate. The colours in this case were blue and white with an admixture of pale green. Here, again, there were three rows of panels; the lowest was blue, with white vertical stripes, over which lights were festooned, the middle row showed transparencies executed in silk, corresponding to

GLASGOW CORONATION CAR REPRESENTING A 16TH-CENTURY VESSEL.

those on car No. 1, but with blue substituted for red. The uppermost row had a blue foundation with white lattice work, and in addition a wreath encircling a crown. Over all there were festoons of evergreens. A feature of this car was two neatly constructed hexagonal towers, studded with lights on each rib, with circular openings on sides, glazed with white silk and illuminated within. Festoons of lights proceeded from the top of these conical towers to a clump of greenery at the sides of the car, again forming into a brilliant diamond.

No. 3 design (which we illustrate) might be described as typically Scotch. It represented an old embattlemented ivy-covered castle with diamond-paned Gothic windows, crowns and cannon, and flagpoles, from which the old National Flag, St. Andrew's Cross, fluttered. In the case of No. 3 a row of amber-coloured lights toward the bottom were made to represent flowers growing around the base of the castle.

No. 4, which we also illustrate, has been wrongly described as a Viking ship. It has been designed to show a 16th century vessel, and may be taken as representing the period when Scotland had a navy of her own. It was the gallant James IV who first created an effective Scots navy. His special pride was the *Great St. Michael*, the largest ship then existing—the *Dreadnought* of her day—to build which he wasted all the woods of Fife, and she cost the enormous sum, in those days, of £30,000, and carried a crew of 300 sailors, 120 gunners, "more great ordnance in her than the French King ever had to the siege of any town," as James himself boasted, and 1,000 marines.

St. Michael, the Archangel, is represented in the car-ship by the armed figure at the prow, but the design of this car more nearly approaches the type of the ships of James V. As the cross on the car-ship indicates, James was the last king to rule over Roman Catholic Scotland. Glasgow's *St. Michael*, which has been designed in honour of the Coronation of James's lineal descendant, King George V, has been constructed and illuminated by Messrs. Claud Hamilton, Ltd., Glasgow and Aberdeen.

The designs and decorative work of cars Nos. 1, 2 and 3, were by a Glasgow firm—Messrs. Wylie & Lochhead, Ltd., upholsterers to his Majesty the King. The Corporation Tramways Department were responsible for the illumination effects.

CORONATION ELECTRICAL ILLUMINATIONS.

ELECTRICAL engineers in many of our towns seem to have been showing considerable enterprise and ingenuity to secure the most telling effect from local illuminations for which they were responsible. Among other examples that have been brought to our notice was the effort of the Borough Electricity Department at Islington. Nightly in this London borough does Mr. Albert Gay's department tell forth in letters of light that "electricity is cheaper than gas," and that "power 1d. per unit, lighting 3d. per unit" are the charges which make it so, but at Coronation time this was placed in the shade, so to speak, by the erection, at a height of about 180 ft. between the two chimneys of the electricity works, of a length of 140 ft. of "Fairyland" strip bearing 300 16-C.P. lamps, supporting at different points of the strip three stars, each lighted by over 30 16-C.P. lamps. It will not be difficult for the reader to imagine that lights fixed at such a height presented a unique effect, and they were visible from all points for miles around.

At Bedford the Electric Lighting Department carried out the illumination of the Town Hall and the river under the supervision of Mr. R. W. L. Phillips, the borough electrical engineer. We have been privileged to see a number of photographs of the night effects, and from these we gather that the result must have given the Council and the public considerable satisfaction. Altogether some 8,130 coloured lamps were used in the scheme, which embraced the two sides of the river between the Town Bridge and the Suspension Bridge, three bridges, and the Town Hall. The Town Hall, in addition to festooning, had a large electric crown and two letters "G." and "R." On the bridge over the Duck Mill weir appeared the crown over the date "1911" and the Royal names in blue lamps with a green border. The stone arches of the Town Bridge were picked out in red and white, whilst over the piers and along the string course ran a line of green lights. Festoons of white lamps hung from the lamp-posts over the parapets, and the letters "G." and "R." were in amber-coloured lamps.

The Suspension Bridge was adorned with lines of red, white and blue, and also green lamps, outlining the principal features of the structure. The letters G. and M. in amber were shown on either side of a device of shield and draped flags.

On both sides of the river were festoons of red, white and blue, alternating with green, hung between the trees, and on poles where trees were wanting. The festoons appeared on the water-edge round the rink island up to the locks, and then lined the path in the recreation ground and on the Embankment at a little distance from the water, so that the trees were silhouetted in the reflection. The lamps were placed 10 in. apart, 15 lamps in each series on 210 volts.

About 300 lamps were utilised for the illumination of the *Lodore*, which headed the procession of boats. The electric current for the lamps was supplied from an accumulator carried on board.

No doubt it has struck many of our readers in different parts of the country that it was a pity that so much good work should be expended upon illuminations which were only to serve for a night or two—especially when they formed such excellent advertisements for electricity! We can quite understand the desire to get rid of imitation foliage and some other decorations that were none the better for the downpour of June 23rd, but to quote the first case that comes to us as we write, what a splendid advertisement it would have been for the London, Liverpool and Globe if it had made its electrical illuminations a permanent, or at any rate a continued, nightly display! At Bedford, we are glad to learn, the extensive installation referred to above is to remain up all through the summer, and the illuminations will be repeated on gala nights, such as the regatta on July 27th. If it is not too late, perhaps other places, where the idea has not been mooted, will see the wisdom of continuing their illuminations, per-

haps as an advertisement of the town, perhaps, because their loyalty is not satisfied with a mere passing and temporary outburst, and partly, though only incidentally, of course, because the electricity supply department stands to gain both from the general advertisement and from the addition to its load.

THE CONFERENCE ON THE EDUCATION AND TRAINING OF ENGINEERS.

THE lecture theatre of the Institution of Civil Engineers was very well, but not uncomfortably, filled, on Wednesday last week, when Mr. Alexander Siemens, as president both of the Institution and of the Conference, opened the proceedings. He said that in calling this Conference together the Council had endeavoured to define the scope of discussion by declaring its object to be—

"To consider the methods of preparation to be adopted by those who contemplate entering the engineering profession in compliance with conditions laid down by the by-laws for election into the Institution."

The by-laws demanded that a candidate should possess :—

1. A sound general education, developed upon lines suited to subsequent scientific study ;

2. A competent knowledge of those branches of science which form the basis of engineering ;

3. Practical training under actual engineering conditions.

In addition, there was the necessity common to all professions, which Prof. Max Müller, in his first lecture on the Science of Language, defined as follows :—

". . . . no science and no art have long prospered and flourished among us, unless they were in some way subservient to the practical interests of society . . . . that interest depends on the practical advantages which society at large derives from these scientific studies."

Applying this principle to the problem submitted to the Conference, it might be expressed by saying that a young engineer should be educated so as to become a dividend-earner for his employer, for this was the most reliable indication of his merit, and the corresponding reward would not be wanting. For the same reason he should possess some knowledge of business methods and of law, not with a view of becoming his own lawyer, but in order to be able to judge when legal advice was needed.

Besides all these requirements, he would find one or more modern languages very useful for obtaining remunerative employment, as the value of his services was thereby increased in the estimation of his employer.

It was hardly necessary for him to insist on the value of proper training for engineers after what he tried to demonstrate in his address last year, that modern civilisation owed its characteristic features to the success of the engineer in improving communications and in superseding manual labour by mechanical power.

While it was not proposed that definite resolutions should be arrived at by the Conference, but that it should be simply a means of forming and maturing the views of those interested in the subjects brought forward for discussion, the Council had felt that it would be desirable to give the widest and most immediate publicity to the proceedings of the meetings, and had accordingly invited the attendance of representatives of the Press at the gatherings. In this respect, the course taken differed from that adopted for the professional discussions of the Institution.

Mr. Siemens then proceeded to express the great regret which all attending the Conference would feel at the enforced absence of Prof. Capper, confined to St. George's Hospital as the result of an accident, and of two of the Vice-Presidents of the Conference, namely, the President of the Board of Education (Mr. Walter Runciman), and the Secretary for Scotland (Lord Pentland).

The other Vice-Presidents, Sir William White and Sir John Wolfe Barry, then addressed the meeting. Sir William remarked upon the fact that that Conference represented the third step taken by the Institution of Civil Engineers in recent years with regard to the education of engineers. The first step was taken during Sir John Wolfe Barry's presidency with its introduction of the examination system as one qualification for membership ; the second step had been the Conference on Education during his own presidency, and the third would be the revision of their own by-laws with regard to the training of engineers. In passing, he made reference to the fact that the introduction of examinations had resulted in a coaching system, not exactly along lines which they had anticipated. In the first instance, British training had been mainly practical. Then came a revulsion of feeling which had made it mainly scientific. They now realised that it was necessary to blend these features. The President and Council of the Institution of Civil Engineers, in summoning that conference, were serving not only the interests of that Institution, but those of the whole profession.

Sir John Wolfe Barry expressed his entire belief in the best possible practical training being given to engineers, but felt that the grounding of a thorough scientific training was of equal importance. The introduction of the examination system had been to the advantage of the entire profession. He felt, too, that the general education of an accomplished gentleman should not be lost sight of.

The Conference then split into two bodies, Section III remaining in the lecture theatre, while Sections I and II adjourned to the library.

Dealing with the subject of Literary Education and Engineering before Sections I and II, the Rev. James Gow, Headmaster of Westminster School, said that Latin was seldom included in the preliminary education of an engineer, or boys who intended to be engineers paid little attention to this subject ; and it was probable that, where Latin was neglected, no very close study was given to any other language. He proposed to argue that a literary education, up to a certain point, was of as much value to the engineer as to anybody else ; and that, at least in the higher walks of his profession, he was likely to be injured by the want of it.

It was notorious, at least to schoolmasters, that a boy who passed from the classical side to the modern side of a school had an immense advantage in inductive science over those who had been educated entirely on modern lines. Latin, as taught, with grammar and dictionary, was inductive science almost in the abstract. Language was incomparably the cheapest and the most rapid introduction to inductive science ; and a boy who had had a thorough drilling in Latin had acquired orderly habits of mind which made inductive natural sciences easy to him.

Secondly, the engineer was doubtless often called upon to command a gang of foreign workers. The sooner and the better he learnt their language the more easily he would control them and direct their labour. The necessary elements of language must always be the same, and the man who, by training, was alive to this fact and on the watch for these elements, had a great advantage over another who learnt at haphazard.

Thirdly, though it was perhaps not the business of the engineer to make contracts, it was undoubtedly his business to understand them and to give and receive orders accordingly. These transactions required a careful and exact appreciation of words. The larger the interests in which the engineer was concerned, the more necessary it was that he should study his instructions closely and be quick to discern a verbal difficulty.

Something also should be said of literary studies proper—the world of books, poetry, history, and the rest. It would be advantageous to the engineer to discern not only what was mathematically possible but also what was artistically impossible ; not only what was cheap, but also what was nasty. For this purpose some general culture was necessary, such as made a man liberal in mind and sympathetic to the common run of his fellows. And this same culture which kept a man from being a prig might also serve to keep him from becoming a beast. Most of the mischief that was done in life was done in leisure, and the rational employment of this time was the real object of general education. The man who could be happy with a good book was master of himself, and saved from a hundred base temptations to which the engineer was peculiarly liable, since he was so often lonely in a far country and a cruel climate. There was no fear that literary culture would absorb too much time. The boy who was going to be a first-rate engineer would not take any more literary education after the age of 16 or thereabouts. The best plan was to give a boy a general education, mainly literary, up to 16, and at that point to watch him closely, and put him to what he wanted to learn. If he was clever, he would be successful ; if he was not clever, he would at least be happy and proud of his calling.

"The Extent to which Mathematical and Scientific Subjects should share with other Subjects of Literate Education the Attention of Schoolboys who intend to enter later the Engineering Profession," was the subject discussed by Prof. S. P. Thompson. He said that in the present chaos of secondary education, the schools of the type which chiefly furnished boys to the engineering profession were almost wholly destitute of any organisation adapted to that end. In general, schoolmasters devoted their energies to preparing a few scholarship candidates, and had no definite educational aim whatever for the bulk of the boys. Until this hopeless state of things was radically altered, British education would continue to be in a bad way. He contrasted this state of things with that which existed in the secondary schools all over Central Europe. If the

German boy failed to pass the Maturity Examination of his school, he was marked as unfit for professional life. The immense advantages of the reasoned organisation of these secondary schools could hardly be overstated. A good systematic secondary education was guaranteed to the majority of the boys.

Here the State had not yet (save in Scotland) organised the secondary schools. Each University wasted its energies over holding matriculations and the like. Almost all the professional bodies also held amateur matriculations or preliminary examinations of their own to test the general education of candidates for entrance. The result, educationally, was muddle, waste, inefficiency.

Eight years ago the Institution of Civil Engineers appointed a Committee to report on the best methods of training for all classes of engineers. The recommendations in respect of preparatory education, contained in pages 8 to 10 of the Committee's Report, stated admirably, from the point of view of the engineering profession, the requirements toward which the schools should be organised to work.

Many mistaken notions were abroad as to science teaching in schools. At school the first object of science teaching should be to evoke interest, not to impart the facts or data of science, still less to systematise their re-discovery. All that had its place later. The fossilisation of science teaching was the thing now most to be feared. Elementary mechanics, the foundation of all engineering, could be made thoroughly attractive by a live teacher who handled his subject in a human way. The bad teacher, of course, could make even electricity as dull and distasteful a subject as the conjugation of irregular verbs. Not until a boy was 15 or 16, and was approaching the stage of matriculation, should science be allowed to degenerate into a grind. Any specialisation in scientific subjects before that stage had been passed was essentially out of place and harmful.

A great change had come over mathematical teaching during the last 10 years; the recommendations of the Institution Committee of 1906 had already been widely adopted in the schools.

One difficulty had been the stupidity of inspectors who had not grasped the importance of the reforms. The benumbing influence of the older Cambridge traditions was also felt. Bad teaching was responsible more than anything else for distaste for mathematics. A really capable teacher would make his boys enthusiastic over matters that, in the hands of others, were deadly dull.

Of all the changes that had come over the teaching of mathematics, the greatest was the almost complete disappearance of Euclid. Theoretical geometry was now taught on other lines. But he was not sure whether the loss was not greater than the gain. If it were approached rightly, after practice in geometrical drawing which familiarised the learner with the concrete facts, the study of Euclid constituted an unrivalled training in methodical and cogent reasoning. But Euclid was gone, and it was his deliberate opinion that boys nowadays were less capable of following a sustained train of thought than they used to be. Training in thinking and in the correct expression of thought was more essential than the study of any particular subject. These things were more important in the long run, and vastly more important in the ultimate making of a professional engineer, than the acquisition of a hoard of scientific facts.

The discussion on these two papers was opened by SIR JOHN WOLFE BARRY, who was strongly opposed to any system which encouraged the degeneration of secondary schools into houses of cram. He had seen secondary schools where too much was attempted with boys up to 16 years of age. The mind required development, and he quite agreed with Dr. Gow that the training of the mind resulting from the study of languages was correct and beneficial. Both authors agreed that specialisation up to the age of 17 was undesirable. Another point of view was that they did not want to make engineers merely engineers, but also men who could adapt themselves to the exigencies of life. More culture was wanted; and it must be brought into a boy's ideas in his early years.

MR. THEO. REUNERT said he entirely concurred in the views advanced in both papers.

MR. W. H. D. ROUSE thought that, as a rule, parents should direct the curriculum, although he had known instances where they desired that boys should not take certain subjects of general utility, because they considered that those subjects would be of no use in the particular professions their sons were intended for. The schoolmaster was subjected to the influence of uninstructed public opinion, as well as of various public bodies which generally consisted mainly of ignorants. He quite agreed that the multiplied examinations were working much mischief. Oxford and Cambridge local examinations were simply hotbeds of cram. No education imparting general intelligence could possibly be carried out by schools preparing pupils for these local examinations; and no examination could be conducted on healthy lines without the co-operation of the State or outside bodies and the teachers.

MR. W. WHITAKER was of opinion that Dr. Gow had rightly stood up for the educational value of literature. The study of science would be much more beneficial if it were carried out with greater regard to making it interesting: and he shared Prof. Thompson's regret at the discontinuance of the study of Euclid, for there was nothing to supply its place. The real object of education was to get them into good methods of thought and not to store the mind with facts.

DR. R. M. WALMSLEY thought that parents were largely to blame for miseducation. The difference in the value of a Scotch and a English education was due to the different degree of interest taken by the parents. It was necessary to instruct public opinion as well as pupils. The prevailing absence of an adequate knowledge of German was a serious matter for English engineers.

DR. STANLEY DE BRATH thought that want of system in the early years of boys' training was responsible for the present unsatisfactory state of affairs. There was a lamentable want of interest in the matter.

PROF. ABEL pointed out the importance to engineers of an adequate knowledge of the properties of matter and of learning to think dynamically, but problems were mostly brought down to that state in which they could be solved statically. As a means of inculcating coherent thought Euclid was invaluable, and its study should be insisted on.

COLONEL CAPPER, R.E., said the importance of a sound general education during a boy's earlier years could not be overrated. Technical specialisation was best deferred.

MR. T. H. BAILEY said that sometimes the clever boys were not successful. Public schools did not want to turn out professional men, but to give that sound general and moral training which would fit students to take up any technical subject.

DR. GOW, replying, said that public schools would welcome advice and information from that Institution.

PROF. THOMPSON pointed out that the existing deficiency of secondary education was not the fault of the schoolmasters. A departmental committee was now considering the subject. Dr. Gow and himself both deprecated too early specialisation.

"The Question of Specialised Entrance Examinations for Courses of Study in Engineering Science" was the subject of the address by Prof. Alfred Schwartz, who defined the functions of the secondary school and of the college course as follows:—

(*a*) The function of the secondary school is to give a liberal general education, that is, to impart a limited amount of knowledge, in a range of subjects so selected and dealt with as to develop the mental faculties in a comprehensive manner.

(*b*) The function of the college course is to impart a certain amount of knowledge of a specialised character, and to train and develop further the mental faculties along specific lines.

The function of the entrance examination for university or college courses in engineering science might be taken to be the determination of the fitness or otherwise of the candidates to pursue the contemplated course of specialised study.

The matriculation examination of a university should be essentially a test of general education and should admit to all faculties. The governing bodies of the leading professional societies, however, had exhibited a growing tendency to call for some degree of specialisation in the matriculation examinations. These special demands had to be met by the secondary schools.

The average boy of 16 years of age who had had a liberal general education was not usually in a position to negotiate successfully these specialised entrance examinations; he therefore extended his school course, the final portion of which was devoted to "preparing" him to meet the requirements of the examination market, or of his future career.

Mathematics was invariably made obligatory, and the standard of the examination in this subject should therefore be such as might be compassed in the course of a liberal general education. The science subjects selected for tuition varied in different schools, and this fact was recognised in the matriculation and entrance examinations by giving an option to the candidate in the selection of subjects. The fact that these options were widely exercised rendered it impossible to commence the college courses in these subjects otherwise than *ab initio*. It was evident, therefore, that the treatment in the secondary schools of science subjects other than mathematics must be regarded as having an educative value rather than an instructional one.

The object of teaching modern languages in the secondary schools at the present time was not so much the investigation of the logic of language, and the reflex action of its grammar on the structure of other languages, as to furnish the ability to think and speak and write in a foreign tongue. This teaching of modern languages might therefore be regarded as specialised instruction. Here, again, the average boy of 16 years of age fell short of the standard aimed at. Instruction in German frequently formed part of the courses in the engineering colleges, and, regarded as specialised instruction, it was not there out of place.

It was particularly necessary, in the case of the engineer, that his secondary school training should be on as liberal lines as possible, since his subsequent training in the college, the workshop and the office was largely materialistic.

MR. JACKSON, who opened the discussion, expressed his objections to specialised examinations. The real object of any examination was only to ascertain the extent to which students possessed good general knowledge and ability. The danger of making early training too practical, and later training too theoretical, could not be too strongly insisted on.

MR. W. H. PATCHELL remarked that a knowledge of Spanish was more important to engineers than French or German, in view of the immense extent of Spanish-speaking territory open to them in South America. He wished to protest most strongly against certain matriculation examinations, which an honestly educated boy uncrammed could not possibly pass.

DR. W. C. UNWIN, PROF. SPOONER, DR. STANLEY DE BRATH, and PROF. E. W. MARCHANT also briefly contributed to the discussion.

(To be continued.)

Fire.—A fire occurred in a stores shed of the PREMIER ACCUMULATOR WORKS, at Northampton, on the afternoon of June 28th. An employé was assisting in the removal of the stock when he stepped back into a carboy of sulphuric acid.

INTERNATIONAL ELECTRICAL CONGRESS, TURIN.

In our issue of March 31st we gave a list of the subjects to be dealt with at the International Congress of the Applications of Electricity at Turin, in September next. We are now informed that there is every prospect that the Congress will realise the expectations of its promoters, and will result in material benefits to the industry of applied electricity. The General Rules have recently been issued, and can be obtained from the "Congresso di Elettricità," Politecnico, Turin, to which address applications for membership and subscriptions should also be sent. Prof. L. Lombardi is the president, and Messrs. C. A. Curti and G. Semenza are the secretaries of the Organising Committee. Amongst the official reporters, 31 in number, are Prof. S. P. Thompson (on Converters, Rectifiers and Motor-Generators) and Major W. A. J. O'Meara (on the Various Systems of Multiple Telegraphy).

Arrangements have been made to reserve accommodation at ten hotels in Turin, for those who apply for it before August 20th, at reduced prices. The subscription to the Congress is 20s. for full membership, including the entertainments and visits of interest, and a copy of the printed *Transactions*, &c. Members' relations may obtain the right to attend the meetings, visits and entertainments for a fee of 8s. Applications should be forwarded as soon as possible. Besides the official reports, other original communications from the members may be read and discussed, provided that due notice has been given to the Organising Committee. All communications will be printed in the *Transactions* in the language in which they were presented. A list of the papers announced up to the end of May is appended :—

1. M. P. Boucherot (Paris): "Les phénomènes électromagnétiques qui résultent de la mise en court-circuit brusque d'un alternateur."
2. Dr. Hallo (Karlrushe I, B., Germany): "Cascadenumformer."
3. M. Huber Stockar (Zurich): "Aluminium für elektr. Leitungen."
4. Ing. Elvio Soleri (Turin): "Gli estremi limiti di applicabilità dei cavi ad alta tensione."
5. M. J. Routin (Lyon, France): "Regulateurs automatiques."
6. M. Jules Neher (Geneva): "Misuratori elettrici a tariffa multipla."
7. Ing. Alberto Dina (Palermo, Italy): "Su alcuni metodi di prevenzione delle sovratensioni interne."
8. Mr. S. Q. Hayes (Pittsburg, Pa., U.S.A.): "Commercial Apparatus for 100,000 volts service."
9. Prof. Riccardo Arno (Milan): "Watt-voltamperometri elettrodinamici e a induzione."
10. Prof. Riccardo Arno (Milan): "Di una soluzione del problema della compra-vendita razionale dell'energia elettrica."
11. Ing. Pietro Lanino (Rome): "La trazione elettrica in riguardo alle esigenze del servizio ferroviario."
12. Dr. W. Kummer (Zurich): "Ueber die Ausbildung der Triebfahr zeuge für elektrischen Vollbahnbetrieb mit Einphasenwechselstrom."
13. Ing. Guillaume Gyaros (Budapest): "Traction électrique appliquée aux lignes vicinales spécialement par rapport au système du courant continu à haute tension."
14. Dr. Osuke Asano (Tokio): "Progress in Electrical Installation in Japan."
15. M. J. A. Montepellier (Paris): "La technique de l'accumulateur électrique notamment en ce qui concerne l'accumulateur alcalin fernickel."
16. "M. Etienne de Fodor (Budapest): "Etat actuel de la question de la destruction des ordures en combinaison avec les usines électriques."
17. Mr. Leon Gaster (London): "The International outlook in Scientific Illumination."
18. Dr. Charles P. Steinmetz (Schenectady N.Y., U.S.A.).
19. M. le Prof. Quirino Majorana Calatabiano (Rome): "Ricerche di telefonia senza fili."
20. Dr. A. E. Kennelly (Cambridge, Mass., U.S.A.): "The Rotating Electric Current Field."
21. Mr. T. C. Martin (New York, U.S.A.): "The Electrotechnical Industries of America."
22. Mr. C. O. Mailloux (New York, U.S.A.): "Electrification of Railroads."

Durban Corporation Electricity Staff.—The annual gathering of the Durban Corporation Electricity Department, in the form of a smoking concert, took place on May 20th, at the "Prince of Wales Hotel," Durban, when upwards of 50 members of the department were present. The committee responsible for the arrangements consisted of Messrs. Smith, Woods, Harding, Bush, and E. Poole as hon. sec. and treasurer, and an excellent programme was gone through. Mr. Roberts, borough electrical engineer, acted as chairman, and in reply to the toast of "The Department," proposed by one of the visitors, he thanked the staff for the manner in which they had run the department during his absence in England, and said that it was gratifying to know that from what he had seen in England, Durban was maintaining its position in electrical matters. A big field of development was in front of them.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

NEW ZEALAND.—The New Zealand Customs Authorities have recently issued a regulation providing for a form of certificate which is to be sealed to or printed on invoices of imported goods as a declaration of value. This certificate will be accepted as evidence of the proper basis of value for duty of the goods appearing in the invoice subject to the collector's right to challenge at any time the accuracy of the values upon which duty is to be paid. The certificate, of which the following is a copy, is required in addition to the usual certificate of origin for British goods imported under the preferential tariff.

DECLARATION IN SUPPORT OF INVOICE VALUES.

(*To be sealed or printed upon invoices.*)

I, ...

do hereby certify as follows :—

1. That I am (*) ..... the exporter of the goods specified on this invoice or upon the invoice sealed hereto.

2. That the said invoice is in all respects correct and true, and that all charges are correctly and separately stated thereon.

3. That the said invoice exhibits the fair market value of the said goods when sold for home consumption in like quantity and condition in the principal markets of the country at the time when exported directly to New Zealand, without any deduction (*a*) on account of bounty, or on account of any royalty actually payably thereon, or payable thereon when sold for home consumption, but not payable when exported ; or (*b*) on account of any discount for export only or on account of any special discount or cash discount except where so clearly and separately specified, or on account of any special consideration whatsoever.

4. I also certify (*a*) that, unless otherwise clearly stated, all prices or discounts specified in the said invoice are allowed to all buyers of similar quantities alike, and that they are not specially cut prices or discounts, or discounts or prices allowed specially to agents or on account of a contract to take goods greater in quantity or value than those appearing upon the said invoice within a stated period ; (*b*) that no arrangement or understanding affecting the purchase-price of the said goods has been, or will be, made or entered into between the said exporter and the purchaser, or by anyone on behalf of either of them, either by way of special discounts, rebate, salary, compensation, or in any manner whatsoever other than as shown in the said invoice.

Signature.....

Witness.....

Dated at....., this.....day of ....., 191 .

The surtax of 2½ per cent. of the amount of duty payable at the rates specified in the Tariff, which has for some year or more been levied on all goods with the exception of tobacco, cigars and cigarettes, has been abolished to date from March 31st of this year.

FRANCE.—The French Customs Authorities have issued the following decisions as to the duty to be levied on certain imported goods :—

Sliding rails of iron or steel for conduits for electric tramways are to be dutiable as "rails of iron and steel" if they are rough or simply pierced with holes for the bolts. If they are thinned and planed or otherwise marked they are to be dutiable as "fixed railway material."

SALVADOR.—The Salvadorian *Diario* for April 6th contains a Decree of the National Assembly imposing a surtax of 20 per cent. (payable in gold) of the duties inscribed in the Customs Tariff, in respect of all merchandise imported into the Republic except flour, and certain specified cotton goods and leather, the Tariff duties on which are reduced.

Stoker Contracts.—The following is a list of recent sales of stokers, &c., for electrical undertakings by the UNDERFEED STOKER CO., LTD. :—Hammersmith Borough, 4 A ; Kensington and Knightsbridge Electric Light Co., 2 E ; United Electric Tramways of Monte Video, 9 E ; Eastbourne Corporation, 2 A ; Borough of Shrewsbury, 2 B.

Coronation Illuminations.—The yellow silk lanterns which formed an important part of the Coronation electrical display in Piccadilly, from St. James' Street to Constitution Hill, were supplied by MESSRS. TAYLOR & CO., of Hatton Garden, to the number of 3,400, to the order of Messrs. Speedy Eynon & Co.

* Insert the word "partner," "manager," "chief clerk," "principal," or "principal official," giving the rank and the name of the firm, as the case may be.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

14,489. "Self-recording electric fire alarm." S. W. H. EDWARDS. June 19th.

14,478. "Systems of electric lighting." S. W. RUSHMORE. June 19th. (Complete.)

14,504. "Production of periodically varing currents of high frequency." E. WEINTRAUB. (Convention date, June 18th, 1910, United States.) June 19th. (Complete.)

14,505. "Electric transportation systems." G. E. VAUGHAN. (M. E. Sturgis, United States.) June 19th. (Complete.)

14,525. "Switch operating and controlling mechanism. J. MCGREGOR. June 19th.

14,569. "Electric telegraphy." E. S. HEURTLEY. June 20th.

14,587. "Mercury, and other vapour, electric lamps." H. A. KENT, H. G. LACELL and SILICA SYNDICATE, LTD. June 20th.

14,590. "Telephone mouthpieces." L. STEINBERGER. (Convention date, August 6th, 1910, United States.) June 20th. (Complete.)

14,591. "Telephone mouthpieces." L. STEINBERGER. (Convention date, August 20th, 1910, United States.) June 20th. (Complete.)

14,604. Electric pocket lamps." E. NEUDOERFFER. June 20th.

14,613. "Telephones." B. GWOZDZ. June 20th. (Complete.)

14,615. "Electric relays." W. R. SYKES INTERLOCKING SIGNAL Co., LTD., J. C. SYKES and R. W. TARRANT. June 20th.

14,619. "Magneto-electric machines." F. R. SIMMS and SIMMS MAGNETO Co., LTD. June 20th.

14,646. "Electrically-driven clocks or watch works of the primary or self-controlling type." T. RUSHTON. June 21st.

14,649. "Metal telegraph poles." J. BRUNSCHWYLER and C. INGLI. June 21st. (Complete.)

14,650. "Electrical distributing systems and fittings therefor." L. M. WATERHOUSE and SIMPLEX CONDUITS, LTD. June 21st.

14,683. "Telephone transmitters." SIEMENS BROS. & Co., LTD., and C. R. RIBER. June 21st. (Complete.)

14,685. "Electric arc lamps." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) June 21st. (Complete.)

14,691. "Telegraph transmitters and the like." J. GIBIANSKY and S. C. J. MERLO. June 21st. (Complete.)

14,704. "Device for operating or controlling electric switches and the like from a distance." J. L. ODGERS. June 21st. (Complete.)

14,727. "Wireless telegraphy." H. MURRAY. June 21st.

14,729. "Electrodes for electric arc lamps." C. CONRADTY. June 21st. (Complete.)

14,731. "Glow lamps for advertising purposes." G. RAINAUD. (Convention date, June 22nd, 1910, France.) June 21st. (Complete.)

14,769. "Batteries." H. W. DARBY. June 21st. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

ALTERNATING ELECTRIC CURRENT DISTRIBUTING SYSTEMS. G. Berry. 12,926. May 27th.

APPARATUS OR APPLIANCES FOR AUTOMATICALLY LIGHTING AND EXTINGUISHING GAS, ELECTRIC AND OTHER LAMPS, AND FOR ANALOGOUS USES. C. Earle. 13,062. May 30th.

SWITCHES FOR USE IN THE CONTROL OF ELECTRIC MOTORS. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 13,195. May 31st.

STARTING DEVICES FOR ELECTRIC MOTORS. Adams Mfg. Co. (Cutler-Hammer Mfg. Co.) 13,224. May 31st.

CONTROLLERS FOR ELECTRIC MOTORS. Adams Mfg. Co. (Cutler-Hammer Mfg Co.) 13,325. June 1st.

ELECTRICAL TRANSFORMERS. British Thomson-Houston Co. (General Electric Co.) 13,694. June 6th. (Addition to 13,278 of 1904).

TORSION DYNAMO METERS. R. R. Bevis and M. G. Clayton. 13,883. June 8th.

LECTRICALLY-OPERATED CARRIAGE RETURN AND LINE-SPACING MECHANISM FOR TYPEWRITERS AND THE LIKE. C. S. Du Belle. 13,910. June 8th. (June 8th, 1909).

MOTOR TRACTORS FOR AGRICULTURAL PURPOSES. P. Saul. 13,932. June 8th.

ELECTRIC FURNACES. C. Hering. 15,189. June 23rd. (July 6th, 1909.)

QUICK-BREAK SWITCH-ON CIRCUIT BREAKER APPL'CABLE TO ARC LAMP AND OTHER ELECTRICAL CIRCUITS. T. Littler, Jun. 16,485. July 11th.

ELECTRO-MECHANICAL CONTROLLING DEVICES. Adams Mfg. Co. (Cutler-Hammer Mfg. Co. 17,110. July 18th.

MEANS AND APPLIANCES FOR REMOVING AND REPLACING ELECTRIC LIGHT OR LIKE BULBS IN THEIR SOCKETS. F. C. Upton. 17,973. July 27th.

ELECTRIC SWITCHES AND SIGNS. W. K. L. Dickson. 18,359. August 3rd.

ALTERNATING ELECTRIC CURRENT MOTORS. British Thomson-Houston Co. (General Electric Co.) 19,359. August 17th.

HANGERS OR EARS FOR OVERHEAD ELECTRIC WIRES OR CONDUCTORS. J. W. Speight and H. R. Walmsley. 21,522. September 16th.

SECONDARY BATTERIES. D. P. Dunne. 21,922. September 21st.

TELEPHONE EXCHANGE CIRCUITS. Siemens & Halske Akt.-Ges. 22,018. September 22nd. (January 29th, 1910).

APPARATUS FOR STOPPING AND RETURNING TO THE INITIAL POSITION ELECTRICALLY OPERATED MECHANISMS. W. P. Thompson. (Wirth, Beck & Knauss, firm of.) 24,808. October 25th.

METHOD OF PRODUCING X-RAY PICTURES AND APPLIANCES THEREFOR. A. Bauer. 25,205. October 22nd.

SUSPENSION CHAIN FOR HIGH-PRESSURE ELECTRIC TRANSMISSION WIRES. Soc. Vedovelli Priestley et Cie. 27,174. November 22nd. (April 5th, 1910.)

APPARATUS FOR CAUSING ELECTRICAL IMPULSES FOR TRANSMISSION TO A DISTANCE. J. A. Gardner and A. Ferguson. 27,223. November 23rd.

TELEPHONE EXCHANGES WITH AUTOMATIC CALL DISTRIBUTORS. Siemens & Halske Akt.-Ges. 27,860. November 30th. (December 9th, 1909.)

ELECTRIC LIGHTING AND LIKE SYSTEMS SUPPLIED FROM VARIABLE SPEED DYNAMOS. Leeds Forge Co. and T. Ferguson. 28,695. December 9th.

COMPOSITION FOR THE USE OF ELECTRIC INSULATING AND OTHER COMMERCIAL PURPOSES. H. P. Rasmussen. 28,834. December 12th.

AUTOMATIC ELECTRIC HEAT CONTROL. H. G. Geissinger. 29,463. December 19th. (December 22nd, 1909.)

MEANS FOR CONVERTING ELECTRIC CURRENTS FOR SUPPLYING ELECTRIC MOTORS. Crompton & Co., Ltd., and H. Burge. 29,726. December 21st.

1911.

ELECTRIC ARC LAMPS. J. O. Girdlestone and C. F. G. Thorkelin. 5,806. March 8th.

ALTERNATING-CURRENT ARC LAMPS. Körting & Mathiesen Akt.-Ges. 6,788. March 29th. (March 29th, 1910.)

ELECTRIC VOLTAGE REGULATORS. Allgemeine Elektricitäts Ges. 7,668. March 27th. (March 26th, 1910.)

MANUFACTURE OF METAL FILAMENTS FOR ELECTRIC LAMPS. G. Ludecke and Imperial Lamp Works (Brimsdown), Ltd. 132. January 2nd.

APPARATUS FOR USE IN WIRELESS TELEGRAPHY. Dr. Erich F. Huth Ges and R. Hirsch. 5,248. March 2nd. (August 3rd, 1910).

ELECTRIC INCANDESCENT LAMP. O. Schaller. 9,815. April 22nd. (April 22nd, 1910.)

Book Notices.—*Arithmetic of Electrical Engineering.* Second edition. 1911. London: Whittaker & Co. Price 1s. net. —In this, the second edition, some additional examination questions have been inserted, and corrections have been made. A great variety of examples, many of them worked out in detail, are given; there is little to be said by way of comment upon them, and we have found very few inaccuracies, though it is not always true (p. 34) that a "B.O.T. unit of electrical energy is supplied when the product of the volts, amperes and hours (during which the energy is supplied) equals 1,000." This is only generally true of direct-current supply. Again, on p. 35, the expression, "candles per hour" is quite wrong. We may suggest that shortened methods of calculation might be introduced where possible, and results should not be shown to unpractical degrees of apparent accuracy. The questions as a whole rather relate to "electricity and magnetism" than to the broad subject of "electrical engineering."

Practical Dynamo and Motor Management. London: S. Rentell and Co. Price 6d. net.—This little book contains concise instructions for the guidance of attendants, showing the probable causes of, and approximate remedies for, a variety of troubles such as are likely to arise in the working of both D.C. and A.C. machines; the matter is plainly written by one who knows what he is talking about, and should be of use to a wide circle of readers.

"Principles of Electrical Engineering." By Harold Pender. 1910. London: Hill Publishing Co. Price 17s. net.

"Steam Turbines." By Joseph W. Roe. 1911. London: Hill Publishing Co. Price 8s. 6d. net.

"Bulletin of the Association des Ingénieurs Electriciens." June 1st, 1911. Liége: Rue St. Gilles, 31.

"Rubber." By Philip Schidrowitz. 1911. London: Methuen and Co. Price 10s. 6d. net.

"Science Abstracts." Sections A and B. Vol. XIV, Part 6. June 26th, 1911. London: E. and F. N. Spon, Ltd. Price 1s. 6d. net each.

Bulletins 1-5, 7-9 and 11 of the Bureau of Mines. 1910. *Bulletins* 366, 383, 385, 402, 412 and 423 of the United States Geological Survey. 1908-9. *Circulars* 1-3 of the Bureau of Mines. 1911. Washington: Government Printing Office.

"The National Insurance Bill Summarised." By L. W. Evans, M.P. 1911. London: National Union of Conservative and Constitutional Associations. Price 1d.

The Chamber of Commerce Journal publishes with its July issue a Special Supplement dealing with the British Empire as a supplier of foodstuffs and of raw materials for British industries.

The Hill Publishing Co., Ltd., have issued a new catalogue of technical and scientific books published in connection with *Power* and other well-known American journals, copies of which will be furnished free on application.

Patent Applications.—The Saltpetersäure Industrie-Gesellschaft G.m.b.H. have made application for the restoration of their patent No. 7,320 of 1907, for "Improvements in arc furnaces for the electrical treatment of gases."

Mr. Samuel Marsh Young has applied for the restoration of his patent No. 13,746 of 1903, for "Improved method for operating signals on electric railways."

The International Rotary Motors, Ltd., and W. A. Richards have applied for the restoration of patent No. 18,193 of 1904, for "Improvements in and relating to internal combustion engines," granted to C. W. Redrup and W. A. Richards.

All the above expired owing to the non-payment of renewal fees.

It is announced in the *London Gazette* of June 30th that the Automatic Electric Co., the owner of patent No. 809 of 1908, granted to W. P. Thompson for "Improvements in automatic calling devices for telephone exchanges" (communicated by the Strowger Automatic Telephone Exchange, of Chicago, now absorbed in the Automatic Electric Co.), has applied for the term of the patent to be extended. The application will be heard in the Chancery Division in London on July 29th. Messrs. Bower, Cotton and Bower, 4, Bream's Buildings, Chancery Lane, E.C., are the solicitors for the petitioners.

The Royal Show.—The silver medal was presented to MESSRS. R. A. LISTER & Co. by the Royal Agricultural Society at the Royal Show, Norwich, for the Bruston automatic electric lighting plant. His Majesty the King inspected the plant in operation and had the system explained to him by Sir Ashton Lister.